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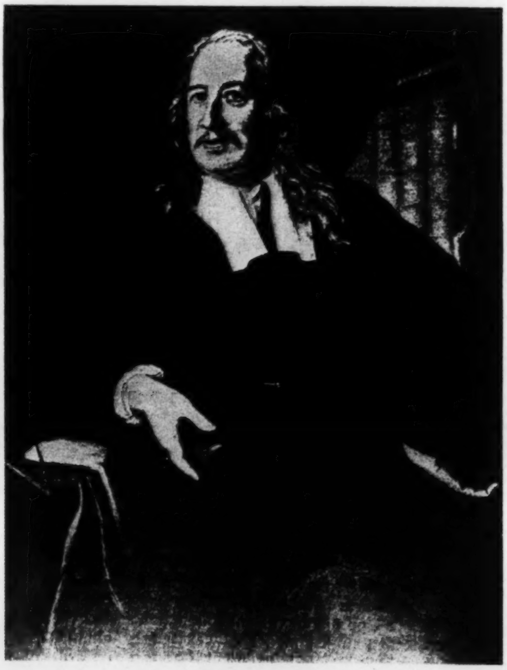

OLOF RUDBECK THE ELDER
[1630-1702]

From a Painting by Martin Mitjens

(*See* Page 301)

[From Fernelius: Universa Medicina, Geneva, 1679.]

ANNALS OF MEDICAL HISTORY

VOLUME X FALL, 1928 NUMBER 3

BLOOD TRANSFUSION BY RICHARD LOWER IN 1665*

By MERRILL W. HOLLINGSWORTH, M.D.

SANTA ANA, CALIF.

TO Richard Lower is given the credit of having performed the first successful blood transfusion. He incorporated a report of this operation in his book on the heart. Dr. A. Elmer Belt acquired a copy of this book which the reader may observe from the photograph of the title page, is of the third and last edition. Garrison, in his "History of Medicine," states that the appendix relating to the origin of catarrh was not included until the seventh edition but it is in this copy, which was published in the lifetime of the author. I can find no record of a translation of this work, and the Surgeon General's Library informs me none is known there. I am indebted to Dr. George Dock for his helpful suggestions.

THE ORIGINAL LATIN AND THE ENGLISH TRANSLATION

De Transfusione Sanguinis ex animali alio in aliud: Quo tempore & qua occasione ab Authore inventa sit.	Transfusion of Blood from one animal into another: the date and occasion it was devised by the author.
Quae hactenus dicta sunt de sanguine, ea pertinent ad *circularem* eius *motum*, qui intra *sphaeram unius corporis* absolvitur; Nimirum collatis quasi rationibus accepti atque expensi, mensuram liquoris etc. temporis spatium, quo *sanguis* per *ventriculos cordis* e venis in arterias *eiusdem animalis* trajicitur, ad calculos revocavimus. Nunc	Up to this point we have considered the circular motion of the blood only as it is limited to the orbit of a single animal body. We have also computed and set down figures to estimate the blood-volume and the length of time it takes the blood to be pumped from the veins through the ventricles of the heart back into the arteries of the same animal. We will now extend

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* Translated from the Latin by Merrill W. Hollingsworth, M.D., Associate Professor of Syphilology, College of Medical Evangelists.

*Translated from the Latin by Merrill W. Hollingsworth, M.D., Associate Professor of Syphiology, College of Medical Evangelists.

quod porro tradituri sumus, *De ipsius transfusione ex hoc in aliud animal* nescio ante trienium proxime elapsum, an cuiquam injecta sit aut perficiendi spes aut experiendi cogitatio. Nam et postquam in publicum proposita res est tanquam magnos usus in medicina habitura; plerique tamen operis difficultate absterriti et novitate perculsi, aut manus ab experimento abstinebant prorsus, aut frustra admovebant: Ut tandem veluti obsoleta *Pythagorae* fabula, et vanior altera μετεμψὺχωσις optari potius ab inconsultis quam a sapientibus sperari videretur.

Itaque lubet mihi rem totam, ut gesta est, exponere, simulque ostendere, et qua ratiocinandi serie, a me primum *excogitata* atque *suscepta*, & quibus demem mediis & auxuliis *ad effectum perdicta sit*.

Complures anni sunt cum alios Oxonii viderim, & ipse experiendi causa, varios liquores opiates, emiticos, multosque id genus medicinales in vivorum animalium venas injecerim; quo id fiat artificio jam satis notum, nec juius loci dicere quos eventus atque exitus singula experimenta habuerint: Cum vero insuper plures alimentares succos simili modo infuderim, atque cum variis vini, tum cerevisiae injectionibus sanguinem diversorum animalium satis apte & amici congruere vidissem, animum mox subiit experiri, annon multo magis sanguis diversorum animalium inter se conveniret & sine periculo aut lucta commisceretur. Etquoniam in cruore extravasato [utcunque satis praecaveri posset, crebra agitatione, ne coagulatur] nativa tamen crasis partiumque textura ut immutetur necesse est; idcirco lenge mihi commodius videbatur, animalis vivi et adhuc spirantis sanguinem illibatum in aliud transmittere; quod etiam facilius peragi videbatur, quod motum sanguinis per vasa sua tam citatum & rapidum, ut in momentis aliquot totam tam fere sanguinis massam qua data porta effluere observassem: Quare spem hinc animo concipiens ad experimentum eius tentadum animum & manus adhibui.

the discussion further. I am unaware as to whether or not the idea or hope of transfusing blood from one animal into another has ever occurred to anyone else previous to the last three years. For when this operation, which should prove such a great boon to medicine, was first publicly proposed, many were frightened by its technical difficulties or appalled by its novelty and either did not apply their hands to the experiment at all, or else applied them to no purpose. So that old fable of Pythagoras, or the still more groundless transmigration of souls, seems to be more desired by the ignorant than hoped for by the enlightened.

I am therefore pleased to relate in detail all the circumstances that lead me to the idea and the ways and means of its accomplishment.

For several years I had been attending meetings at Oxford during the course of which some experimental work was undertaken. I would inject various solutions of opiates, emetics, and kindred other medicines into the veins of living animals, and thereby perfected my technique. Although one is not justified in drawing general conclusions from a single experiment, nevertheless while I was pouring in various alimentary juices and had noticed that the blood of different animals mingled freely after injections of various wines and beers, the thought entered my mind to see if a much greater quantity of blood from different animals could be mixed without altering it in any way. Since the natural texture and viscosity of extravasated blood necessarily changes [no matter how carefully coagulation is guarded against beforehand by repeated shaking] it seemed to me more expedient to transfer the unaltered blood of one living, breathing animal into another. This seemed possible of more easy execution on account of the rapid flow of the blood through the vessels. I had observed almost the entire blood supply flow out from a severed vessel in just a few moments. From this I took hope and turned my attention to the experiment.

Et primum fistulis hinc inde adapatis a vena *jugulari* hujus, in *jugalarem* alterius transmittere conatus sum, sed cum propter languidum sanguinis venosi motum, eum in fistula concrescere statim & sibi ipse viam obstruere viderem, mox aliam viam tentare soepi & praeunte quasi ipsa natura statui tandem ex *arteria* unius in *venam* alterius sanguinem transvehere, novoque hoc artificio ipsius circulationem quasi ultra praefinitos limites extendere.

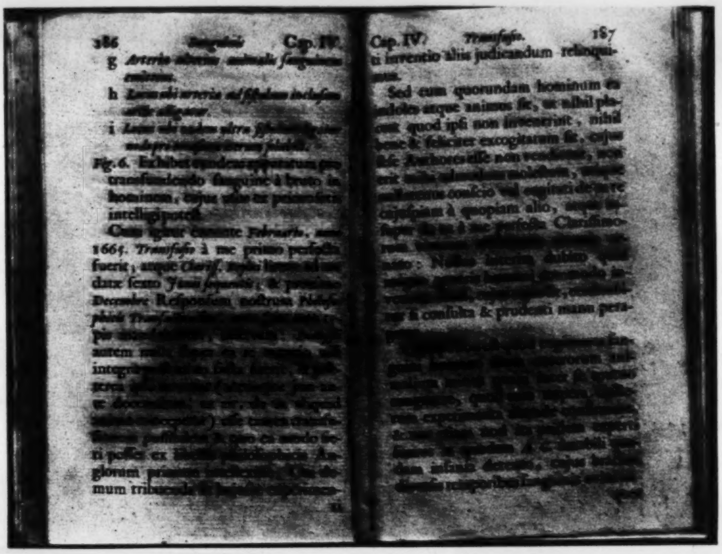


FIG. 1. IN THE THIRD LINE FROM THE BOTTOM OF PAGE 187 MAY BE SEEN THE REFERENCE TO THE CASE OF A. C. AN ACCOUNT OF THE EXPERIMENT OF TRANSFUSION PERFORMED AT ARUNDEL HOUSE, NOVEMBER 23, 1667, UPON THE PERSON OF ARTHUR COGA MAY BE FOUND IN "PHILOSOPHICAL TRANSACTIONS," NO. 30, PAGE 557. SEE ALSO FOOTNOTE 2.

Quocirca cum ex voto omnia expectationi responderent, tandem *Oxonii* sub finem *Februarii* anni 1665, praesentibus Doctiss. viris Doctore *Joanne Wallis* Mathematices Professore *Savilliano*, Domino *Thoma Millington*, Medicinae Doctore, aliisque ejusdem Academiae Medicis experimentum hoc novum jucundo sane spectaculo atque optimis auspiciis exhibui.

Nimirum comparatis canibus, caeterisque quae ex usu esse videbantur, exeorum uno mediocris magnitudinis, aperta vena *jugulari*, sanguinem eousque detraxi, donec ejulatu & summa contentione vires jam fatiscere & spasmos imminere satis constaret: Deinde ut tanto hujus dispendio

In my first attempt at transfusion I connected the jugular vein of one dog with that of another by means of a cannula. However, the comparatively slow flowing venous blood immediately coagulated and obstructed the lumen of the tube. Then I decided to try another plan, one that would more closely follow nature, and convey the blood from an artery of one animal into a vein of another. This would literally extend the limits of the circulation prescribed by nature.

In response to invitation there were present at Oxford towards the end of February, 1665, Doctor John Wallis, Professor [of mathematics] Savilliano, Dominic Thomas Millington, M.D., and others from the academy of medicine, before whom I performed this spectacular new experiment.

From the dogs suitable for experimental purposes I selected a medium-sized one and drew off its blood from an exposed jugular vein. The dog first set up a wailing but soon its strength was exhausted and convulsive twitchings began. In order to resuscitate this animal from such a great loss of its own blood with the blood of another, I

alterius sanguine subvenirem, è *cervicali arteria* molossi majoris ad latus ipsius alligati atque compositi sanguinem eousque immisi, usque dum ab irruentis ejus copia sese impleri nimis atque opprimi inquietudine sua rursus fateretur: Quocirca arteria *immittente* iterum ligata, è cane *recipiente* rursus sanguinem detraximus, quod alternis vicibus toties repetitum est, donec in duobus majoribus molossis, (quorum utrïusque sanguinem minor canis exceperat) nec sanguis amplius nec vita superesset: Interea ut minor iste, licet tantum sanguinis per vices ipsi detractum sit immissumque, quantum opinor totius corporis pondus aequaret, *jugulari* tamen consutà, & vinculis, quibus detinebatur, solutis, à mensa protinus desiliit, & quasi injuriarum oblitus mox domino suo adblandiri, & quo à sanguine se mundaret, in gramine sese volutare, non aliter omnino neque majore incommodi aut offensae indicio, quam si in profluentem solummodo conjectus fuisset.

Horum fama cum mox *Londinum* pervolaret, accepta Epistola à *Clarissimo Boylaeo* impense rogatus sum, ut totius experimenti methodum *Societati Regiae* imperatirem, quod non ita multo post a me praestitum, in *Philosophicis* ejusdem Societatis *Transactionibus Decembre insequente anno* 1666. publici juris factum est. Et tum rumor ejus ad exteras gentes & *Galliam* pervagatus est, ubi mox rei novitate allecti diligentius illam prosequi, & aliis subinde experimentis augere, illustrare, quodque ego solum in brutis perfeceram, ad hominis usum accommodare coeperunt; uti in scriptis illorum *Seq. Martio, anni* 1667. tunc primun editis apparet: Atque haec satis bene & ad gentis istius laudem quod philosophiam & medicinam quoquo modo ornare vel adaugere satatunt. Verum cum per hominum ora jam ubique volitet haec nuper inventa sanguinis transfusio, & *Dionysius* quidam Philosophiae & Mathematices Professor, in Epistola nuper edita celeberrimi hujus experimenti inventionem mihi praeripere & sibi arrogare conetur: Ut quo jure, quave injuria id fecerit, lectori appareat, liceat *Clarissimi Boylei* ad me literas & meum ad eas responsum hic loci inserere.

securely bound a large hound along the smaller dog and allowed its blood to flow from the cervical artery into [the smaller dog]. This rushing in of blood soon transfused too much as evidenced by a returning restlessness of the engorged dog. The artery of the donor was now ligated and blood again withdrawn from the recipient. This withdrawal was repeated in another large dog until neither blood nor life remained. In the meantime blood was being drawn away and turned loose from the small dog, equalling in amount, I would judge, the weight of its body. Nevertheless, its jugular was again joined and its chains unfastened. The animal immediately leapt down from the table and apparently forgetful of its injuries, fawned upon its master. It then cleansed itself of blood, rolled in the grass, and apparently was no more inconvenienced than if it had been thrown into a flowing stream.

News of this operation soon reached London and I received a letter from the Honorable Mr. Boyle earnestly requesting me to communicate the details of the entire experiment to the Royal Society, which communication was published soon afterwards [December, 1666] in the Transactions of the Philosophical Society. The news spread to foreign countries and in France some men, allured by the novelty of the experiment, decided to extend it farther and apply to man what I had only accomplished with dumb animals. Their first publication appeared the following March, in 1667, which is a credit to that nation and an honor to its medical science. As word of this newly devised blood transfusion was fluttering everywhere on man's lips, Dr. Dionys, professor of philosophy and mathematics, in a letter recently made public, attempted to deprive me of the credit of originating this famous experiment and appropriate it to himself. That the basis for this claim and the injury it may have caused may appear to the reader, permit me to introduce at this time a letter from the Honorable Mr. Boyle and my reply to the same:

LONDINI, *Junii 26. 1666*

ADeram *(vir Clarissime) proximo die Mercurii, in solenni Societatis Regie conventu, in Collegio* GRESHAMENSI *habito, ubi cum à D. D.* WALLIS *exaudiveram, difficillimum illud experimentum de sanguine ex Canum altero in alterum transmittendo te tandem (se praesente) feliciter absolvisse: Rem plane dignam judicavi quae celeberrimo isti coetui innotesceret. Adeoque author eram ut illi, à Reverendo viro, rei prout gesta fuerat narrationem exigerent: Cujus ille eam reddidit rationem quae apud nos existimationem famae tuae non parum commendaret. Verum de tam insolito & insperato conamine varia particulatim interrogatus, expedire potius censuit, ut tu de singulis scripto responderes, quam ille viva voce, Quapropter & ego coram indicabam, te mihi dudum pollicitum esse, rem illam [siquando votis responderet] te mihi enarraturum: Quod & te praestiturum in me suscepi; idque eo plenius cum coetum hunc tam celabrem de ejusdem successu accuratius enarrando sollicitum intelligeres. Hoc itaque ut jam dignari velis obnixe rogo, totamque hujus negotii peracti methodum ordine exponere, quae tam prospere successit. Quod eo pressius urgeo, quod ingeniosi admodum viri aliquot & satis critici, nec creduli nimium, rem arduam judicaverint, & audacter dictum, cum ego ante aliquot menses obiter indicaveram, à Societate Regia ad id rogatus, quid tu antehac jam tum* OXONIAE *tentaveras; & quanquam tum temporis, propter instrumentorum apparatum non satis idoneum, non per omnia res ex voto successerat; Non desperasse tamen me, quin illud postmodum absoluturus esse. Avocor ego jam hoc momento, ut non vacet mihi veniami deprecari quod hoc tibi facesserim negotii. Quod tamen eo minus invitus feci, quoniam tuo non cessurum incommodo judicavi, si hac occasione tam auspicata celeberrimus hic coetus te cognoverit. Interquos complures sunt qui te & debite aestimant & amice colunt; & quidem prae caeteris,*

Tui ammantissimus
Rob. Boyle.

Amico plurimum honorando
D. *Richardo Lower*, Medicinae
Doctori, tradantur,

Oxonii.

London, June 26, 1666.

Honorable Sir:

At a meeting of the Royal Society at Gresham College last Wednesday[1] I heard from Dr. Wallis that you had acquitted yourself successfully of that difficult experiment of transfusing blood from one animal into another [he having been present at your experiment]. I decided the operation to be worthy of being made known to that honorable body and accordingly suggested they call upon Dr. Wallis for a description of it. His reply added not a little to your reputation among us. He was of the opinion that you should furnish a written report, rather than that he should tell about it, particularly as the request had come so unexpectedly. I then personally mentioned the fact that a little while ago you had promised to acquaint me with the details of the experiment [when convenient], but that I realized you were more familiar with the subject and consequently in a better position than I to intelligently describe the operation before such an august assemblage. Therefore, I earnestly request you to consider it worth your while to explain the entire technique of the exper ment, in which you succeeded so admirably. Now I urge you to be very exact in this because several clever men who are right up to the mark, critical enough but not too credulous, will pass severe judgment on this lofty subject. They might consider it spoken rashly when, on being questioned by the Royal Society, I incidentally mentioned a few months previously you had already attempted this experiment at Oxford before this although at that time the experiment did not succeed in all respects because some of the apparatus was not suitable. Nevertheless, do not disappoint me in not releasing the story at an early date. I am called away at this moment but I entreat you to favor me by not making my request one in vain. I will not regret causing you this inconvenience if this dignified convention recognizes you on a favorable occasion. There are many men among them who feel under obligation to you and who would like to cultivate your friendship. As for the rest,

Yours respectfully,
Robert Boyle.

To my honorable friend,
D. Richard Lower, M.D.,
Oxford.

Oxonii, *Julii* 6, 1666.

A *Ccepi literas tuas, Honoratissime vir, & prout à me expetis, totam transfusionis methodum eodem, quo ipse ordine perfice, tibi breviter exponam; Itaque canis aut cujuscunque animalis sanguinem lubet in aliud seu ejusdem seu diversi generis transfundere, primo attollatur* Arteria Cervicalis *altera, eademque à nervo* Octavi paris *separata fere ad digiti longitudinem denudetur: Deinde pars ejusdem superior cerebrum versus vinculo stringatur firmo arctoque, utpote quod laxare iterum aut solvere per totum operationis processum non opus est. Mox inferius qua cor respicit eidem vasi ad distantiam sermidigiti à praedicto vinculo altera colligatio aptetur* nodo *ita* solubili, *ut pro data occasione, vinculum adducas cum velis aut remittas. Ligaturis ad hunc modum ex utraque parte dispositis & spatio intermedio duobus filis sub arteria trajectis scalpello ipsa aperiatur & calamus incisurae cor versus inseratur, cujus exterius foramen ligneo bacillo obtruandum est. Arteria autem qua calamo incluso superjacet filis istis arctius circumductis firmiter vinciatur.*

In altero animali quod prioris sanguinem admittere oportet, denudanda est Venae Jugularis *portiuncula semidigiti longa, cujus utrique extremo adhibenda ligatura nodis utrinque ita connexis, ut ad libitum laxare possis aut constringere; quorum interstitio bina quoque fila subter venam ducenda sunt: exinde facta incisione, foramini duo Calami inserendi, quorum alter truncum venae descendentem spectans cruorem ex alio cane influum excipiat atque ad cor deferat; alter sursum versus cerebrum intrusus proprium hujusce Animalis sanguinem in scutellas effendat: Utrumque autem, non nisi ex occasione aperiendum ligneo interim epistomio obuturare oportet, & filis denique, ut supra, venam circumligare.*

Quo facto tandem ipsi canes in latus inclinati juxta se invicum quam commode fieri potest ita deligentur, ut calamorum unum alter excipiat: Verum quia obtortis collis tamprope admoveri non possunt, ideo praeter extremos duos calamos, aliquot intermediis opus est, quibus & copulentur illi & sanguis transvebatur.

Jamque rebus ad hanc rationem instrucitis atque apparatis, jam primum aperiantur duo calami, nempe in hoc Animali is qui in venam *ipsius* Jugularem *descendit; in altero qui prodit ex* Arteria *ejus* Cervicali; *inter quos postquam alii, quot usus erit, interjecti sunt atque invicem coaptati, si in utroque laxentur* Nodi, *quos pro arbitrio* Solubiles *esse jussimus, sanguis illico per calamos, non aliter quam per continuatam*

Oxford, July 6, 1666.

Dear friend:

I received your letter and in accordance with your request I herewith briefly explain the whole method of blood transfusion. Select either a dog or whatever animal you wish to use as a donor to supply blood to another animal of like or diverse species, expose a cervical artery, separate it from the eighth nerve and denude it almost a finger's length. The cephalic end is ligated firmly with a cord as it will not be necessary to unfasten this during the whole operation. Another ligature is placed around the same vessel a half-finger's length below the first and secured by a slip-knot that can be tightened or loosened at will. After the ligatures have been arranged in this manner, that portion of the artery lying between the ligatures is slit with a scalpel and in the incision a reed is inserted towards the heart, with one end projecting free like a little wooden staff. Another ligature is now placed around the vessel enclosing the reed and drawn tight.

The jugular vein of the animal that is to receive the blood is denuded a half-finger's length and at both extremities of the denuded portion ligatures are so placed that it is possible to tighten or loosen the knots at will. Another pair of ligatures is then placed in position between the first pair. That portion of the denuded vein lying between the two middle ligatures is now incised lengthwise and the two reeds inserted, one towards the heart to conduct the blood from the donor and the other towards the head from which the animal is to pour forth its blood into a saucer. In the mean time, it may be necessary to stop up the ends of the reeds with wooden stopples until ready, or to ligate the vein above. The two dogs are now pinioned in juxtaposition so that the reed of one is approximated to that of the other. It will now be found necessary to supply an intermediate coupling to direct the blood from one reed to the other.

On completion of this arrangement of apparatus, the reed leading downward into the jugular vein of the second dog is opened and the one projecting from the cervical artery of the first dog also opened and the two ends connected. Afterwards, the farther knots are to be loosened and immediately the blood will flow through the reeds as rapidly as through an unbroken artery, in fact, just as in an anastomosis. As soon as possible the neck of the recipient is

arteriam facta veluti Anastomosi, impetuosius transilit: Quamprimum igitur ANIMALIS RECIPIENTIS *collum laqueo strinxeris, ut fieri solet in Phlebotomia, aut saltem in oppositi cervicis latere venam digito compresseris, exempto protinus obtruaculo aperiatur* CALAMUS JUGULARIS SUPERIOR *nimirum ut, sanguine alieno per* INFERIOREM *irruente, proprius interim ex isto in patellas effluat (partitis tamen hoc vicibus atque interpolatim habita semper* δαφοιτος *& virium ratione) donec tandem alter canis inter ejulatus, languores, & spasmos postremo animam cum vitali succo effuderit.*

Peracta hac Tragaedia, è JUGULARI *superstitis Animalis eximatur uterque calamus, nodisque, qui prius erant solubiles, jam firmius obnexis discindatur vena, id quod fieri potest nullo fere Canis incommodo, eo quod* JUGULARIUM *circa laryngem praelarga existente* ἀναστόμωσις *una earum sufficiat sanguini è capite deferendo. Discisso vase consuatur cutis, laxentur vincula, & permittatur cani prosilire è mensa: Enimvero ille tanquam suscitatus è somno, concusso paululum corpore, vivus valensque abit alterius sanguine alacrior forte & vegetior quam suo.*

Unicum hoc insuper monendus es, Praestantissime vir, siquidem calami non ita stricte vasis alligari aut sibi invincem adaptari possent, quin ex animalium contentione laxari atque solvi denuo & saepe contingat; ideo consultius duxi in posterum fistulis argenteis in hoc constructis omnino uti: Quae ne à vasis, quibus inseruntur, rursus avelli possint, ideo in altero extremo, circulari aliquo annulo eminenti, & quo securius vasa desuper stringantur, eo duplici firmentur. Et quo minore Transfusionis incommodo, sive vasorum periculo aut impedimento, praesertim ubi animalia varie se jactant & contorquent, res peragatur, uniendae sunt per duas minores fistulas inserendas Arteriae CERVICALI *equo vel bove exemptae, quae omnes ita conjunctae sanguinem ab* IMMITTENTE *ex illa, ad* RECIPIENTUM *ab hac parte fistulam convebant: Cujus Arteriae intermediae atque substitutae hoc habemus amplius beneficium, quod animalibus varie licet renitentibus obediat, tum quod sanguinem in illa contentum si forte stagnare contigerit, pro libitu propellere ulterius & urgere, vel pro re data prorsus supprimere poteris. Haec scripsi quo fidem vestram* ILLUSTRISSIMAE SOCIETATI *pro me datam liberarem, atque amplius ut innotescat nullo studio aut officio tibi unquam defuturum.*

Tui observantissimum
RICHARDUM LOWER.

Honoratissimo D.D.
Roberto Boyle, trandantur
Londini.

constricted with a torniquet as is customary in phlebotomy, or at least the vein on the opposite side of the neck is compressed with the fingers. The reed in the upper end of the jugular is immediately unstoppered so that as the lower end is being filled with blood from the donor, blood, which always divides up into dark red clots as human blood does, may be released from the recipient into a saucer from time to time, until the donor, midst wailing, fainting, and terminal spasms, will give up the ghost with his vital fluid.

After this tragedy is enacted, both reeds are removed from the surviving animal and the slip knots drawn tight where the vein is cut open. This causes practically no inconvenience to a dog as it has adequate anastomoses of the jugulars around the larynx which suffice to carry the blood from the head. The rent in the skin is sutured, the chains removed and the dog permitted to jump down from the table. After shaking itself as though just awakening from sleep, it will be more lively than its partner from whom life and strength departs with its blood.

I have only one admonition, my dear friend, and that is that the reeds be secured in the vessels with tight ligatures before they are approximated; otherwise they will be loosened by the struggles of the animals and the whole thing will be to do over again. As I have become more experienced, I have lately constructed a silver cannula which does not tear the vessel where it is inserted and which has a projecting ring or ridge running around the outside near the end which facilitates securing it inside the vessel. It is more convenient and affords less danger of tearing or obstructing the vessel, particularly when the animals toss and twist about, to procure a section from the cervical artery of a cow or horse and insert smaller cannulas in each end which may be used to connect the cannula of the recipient with that of the donor. This intermediate section from an artery has afforded us better success not only because of its elasticity which allows it to yield to the movements of the struggling animals but also because in case the tube becomes stopped up one can strip down the tube with the fingers, imparting a squeezing motion and start the blood flowing again. This letter furnishes you with the data for the Honorable Society and I trust it will not at any time be found wanting in any respect.

Yours most respectfully,
Richard Lower.

Written to the most honorable
Robert Boyle, D.D., London.

Haec igitur non eo in hunc locum transtulimus, ut transfusioni ipsi, jam satis notae lucem foenerentur, sed ut lectori de Inventionis tempore atque Authore melius constaret, omnis enim ad experimentum illud apparatus atque in illo praestando operatio in sequente tabula tam clare exhibetur, ut alioqui supervacuum fuerit de ea quicquam amplius memorare. *Tab.* 6. *fig.* 1. In qua

a *Fistula argentea.*

b *Pars ejus, quae venae vel arteriae inserenda est, & circulari annulo duplici & eminenti donatur quo securior desuper ligatura fiat.*

Fig. 2. Exhibet fistulam argenteam pro sanguine in brachium humanum convehendo formatam. In qua

aa *Fistula argentea.*

b *Pars ejus minor quae venae brachii inserenda.*

c *Pars ejus major ubi sanguinem excipit.*

dd *Duo ejus folia utrinque peforata pro trajiciendo filo quo bractea brachio alligetur.*

e *Sinus in medio inter utrumque folium excavatus pro fistula immittente commodius excipienda, qui venam subjectam adeo comprimit, ut nihil interim sanguinis ex illa extillare aut erumpere possit, atque satis apte comparari potest foveae in medio labii superioris humani.*

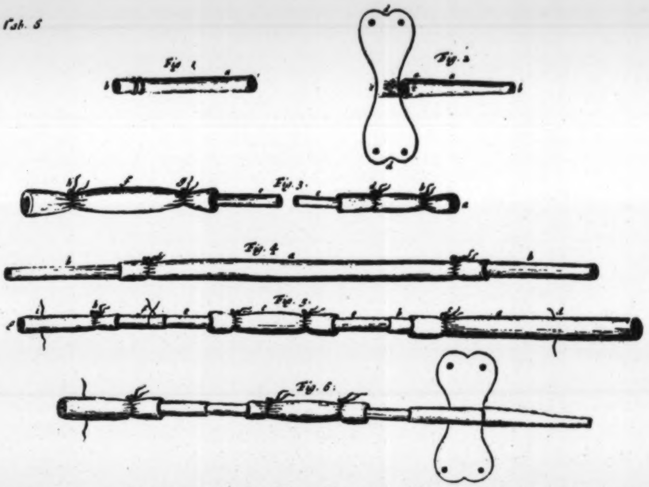


FIG. 2. THE EXPLANATION OF THE ILLUSTRATIONS IN THIS ETCHING ARE FOUND IN THE TRANSLATION OF THE TEXT.

At this point it will be advisable to look at some illustrations, not that the description of transfusion is not sufficiently clear in itself but that the time and origin of the idea may be apparent to the reader. Every apparatus for that remarkable experimental operation is shown so clearly in the plate that it will be superfluous to add anything further. Tab. 6. Figure 1.
In which:

a. Silver cannula.

b. That part of it which is inserted in a vein or artery and the two circular ridges which facilitate secure fixation with a ligature.

Figure 2. Illustrates a silver cannula for conveying blood into the arm of a man. In which:

aa. Silver cannula.

b. The smaller end which is inserted into a vein of the arm.

c. The larger end which receives the blood.

dd. The double leaf with perforations through which threads fix it securely in position on the arm.

e. Middle groove between the wings of the handle to more conveniently adapt it to the cannula of the donor, and to compress the enclosed vein; thus preventing any leakage of blood from the connection.

Fig. 3. Exhibet fistulas arteriae emmittenti & venae recipienti adaptandas ante sanguinem transfundendum.
In qua

a *Arteria cervicalis emmittens.*

b *Eadem arteria nodo iterum solubili arcte ligata.*

c *Fistula pro sanguine convehendo arteriae immissa.*

d *Locus ubi arteria super fistulam inter annulos arcte ligatur.*

e *Fistula pro sanguine excipiendo & in venam jugularem transmittendo.*

f *Vena jugularis.*

g *Locus ubi vena ad fistulam arcte alligatur.*

h *Vena ligata nodo iterum solubili.*

Fig. 4. Exhibet arteriam cervicalem ex equo vel bove exemptam & fistulae argenteae utrinque adaptatam. In qua

a *Arteria cervicalis*

bb *Fistula utrinque arteriae adaptata.*

Fig. 5. Exhibet totum simul apparatum sanguinis ad uno animali in aluid transfundendi. In qua

a *Vena jugularis ad cor Animalis in quod sanguis transmittendus est.*

b *Fistula argentea in venam jugularem immissa.*

c *Vena arcte ligata super fistulam.*

d *Vena ligata nodo facile solubili ultra fistulam.*

eee *Fistulae & cervicalis arteria intermediae quae sanguinem à fistula immittente in recepientem convehunt.*

f *Fistula argentea ab arteria emmittente sanguinem excipiens.*

g *Arteria alterius animalis sanguinem emittens.*

h *Locus ubi arteria ad fistulam inclusam arcte alligatur.*

i *Locus ubi eadem ultra fistulam ligatur nodo pro occasione iterum solubili.*

Figure 3. Illustrates cannulas adapted to the artery of the donor and the vein of the recipient preparatory to transfusion.

a. Cervical artery of the donor.

b. An adjustable ligature placed around the same artery.

c. Cannula for conveying arterial blood from the donor.

d. Place where the artery is tied between the ridges on the cannula.

e. Cannula for conducting the blood into the jugular vein of the recipient.

f. Jugular vein.

g. Place where the vein enclosing the cannula is ligated.

h. Vein with a slip knot adjusted.

Figure 4. Illustrates a section taken from a cervical artery to connect together the two silver cannulas. In which

a. Cervical artery.

bb. Cannula inserted in each end.

Figure 5. Shows in one illustration the entire apparatus for transfusion of blood from one animal into another.
In which:

a. The jugular vein towards the heart of the animal into which the blood is to be transfused.

b. Silver cannula inserted in the jugular vein.

c. Vein encircled with a ligature above the cannula.

d. Vein encircled with a slipknot below the cannula.

eee. Cannulas with a section from a cervical artery in the middle to convey blood from the cannula of the donor to that of the recipient.

f. Silver cannula receiving blood from the artery of the donor.

g. Artery of the animal adjacent emitting blood.

h. Place where the artery enclosing the cannula is firmly ligated.

i. Place where a slip knot is positioned beyond the cannula that can be tightened at will.

Fig. 6 Exhibet eundem apparatum pro transfundendo sanguine à bruto in hominem, cujus usus ex priore satis intelligi potest.

Cum igitur exeunte *Februario, anni* 1665 *Transfusio* à me primo perfecta fuerit; atque *Clariss. Boylaei* literae ad me datae sexto *Junii sequentis;* & proximo *Decembre* Responsum nostrum *Philosophicis Transactionibus*, quae jam tum typis mandabantur, insertum, *Dionysii* autem nulla super ea re mentio nisi integro post anno facta fuerit, & praeterea ipse fateatur (utcunque jam ante decennium, ut ait, de ea aliquid animo conceperat) esse tamen transfusionem possibilem & quo ea modo fieri posset ex sibilem & quo ea modo fieri posset ex libellis philosophicis Anglorum primum intellixisse; Cui demum tribuenda sit hujusce experimenti inventio allis judicandum relinquimus.

Sed cum quorundam hominum ea indoles atque animus sit, ut nihil placear quod ipsi non invenerint, nihil bene & feliciter excogitatum sit, cujus sese Authores esse non venditent, non erit mihi admodum molestum, utique nullatenus conscio vel cogitati de ea re cujuspiam a quopiam alio, atque insuper de ea à me perfecta Clarissimorum virorum testimoniis abunde ornato: Nullus interim dubito quin magno generis humani commodo inventum illud, cujus cujus sit, celebrabitur si consulta & prudenti manu peragatur.

Quippe non est quod cogitemus sanguini humano illum caeterorum animalium minus quam inter se mutuo congruere, quod tum nupera Gallorum experimenta abunde confirmant, & nos etiam non ita pridem experti sumus in quodam *A. C.*[2] amabili quadam insania detento. cujus brachio diversis temporibus sanguinis ovini aliquot uncias in conventu *Regiae Societatis* immitti curavimus, atque id absque omni ejus incommodo: Verum amplius ut nos hoc in eo cum aliquo etiam ipsius fructu experiremur, statueramus hoc idem ad mentem illi saniorem procurandam aliquoties repetere, nisi genio ille magis quam saluti suae consulens spes nostras omnini elusisset.

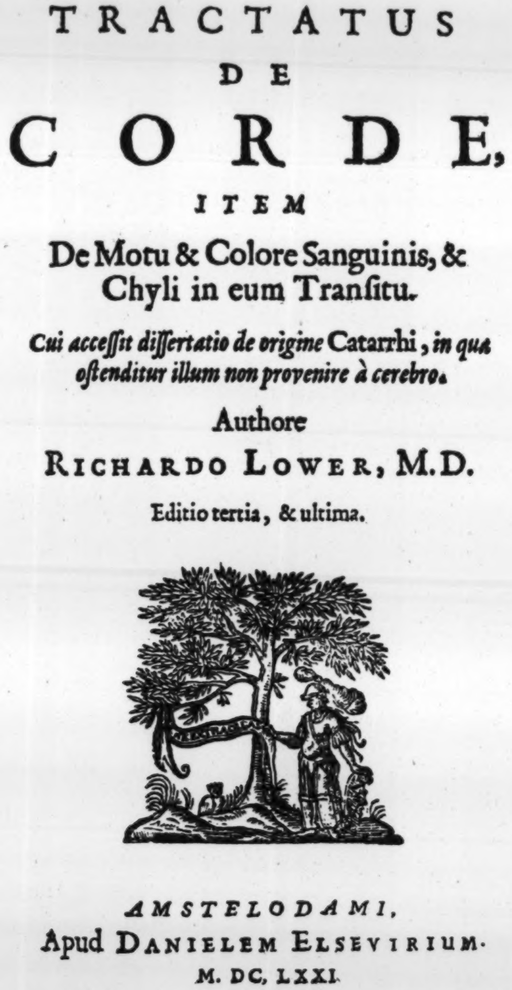
Figure 6. Illustrates the apparatus for transfusing blood from a dumb animal to man, the use of which may be understood from the preceding.

Although transfusion had been perfected by me toward the end of February, 1665, and Boyle's letter to me under date of the sixth of the following June and my reply to same were ordered set up in type for the Transactions of the Philosophical Society the following December, no mention of this was made on the part of Dionys during the whole year afterwards; and furthermore, let him acknowledge [since, as he says, no thought concerning this in any way had entered his mind during the previous ten years] that he had learned of transfusion and the manner of performing it from the Philosophical Journal of England. I will leave it to anyone to decide whether the invention of this experiment should be accredited to him.

But when a man's mind has reached such a state of depravity that nothing pleases him he does not himself originate, or nothing is well planned he does not plan himself, he will not be a worry to me. In any case I am not concerned that this idea ever occurred to anyone else, for abundant testimony of famous men is quoted above that it was perfected by me. Meanwhile there is no doubt that anyone, whoever he may be, who might perform this operation skillfully just at this time, will become famous.

One would hardly consider human blood less compatible with itself than with that of other animals, as recently proved by numerous experiments in France. We have lately proved this in the case of A. C., an amiable man, in whom we have kept back impending insanity by transfusing several ounces of sheep's blood into his forearm at different times before meetings of the Royal Society; this was done without any great inconvenience to him. This therapy was repeated several times in this case and was conducive to a more sound mind, unless his mental state, rather than his physical condition, should prove our hopes illfounded.

Verum enim vero cum ex aequo non omnibus competat alienum sanguinem admittere, neque ullum sit tam utile remedium cui temeraria atque importuna administratio infamiam non facile intulerit, operae pretium fore existimo si paucis saltem & breviter innuam, in quibus corporibus & quo potissimum valetudinis statu transfusio tentanda sit.


TRACTATUS
DE
CORDE,
ITEM
De Motu & Colore Sanguinis, &
Chyli in eum Tranſitu.
Cui acceſſit diſſertatio de origine Catarrhi, *in qua*
oſtenditur illum non provenire à cerebro.
Authore
RICHARDO LOWER, M.D.
Editio tertia, & ultima.

AMSTELODAMI,
Apud DANIELEM ELSEVIRIUM.
M. DC. LXXI.

FIG. 3. TITLE PAGE. "TREATISE ON THE HEART, ALSO ON THE MOTION AND COLOR OF THE BLOOD, AND ON THE CHYLE IN IT'S TRANSIT. TO WHICH IS ADDED AN ESSAY ON THE ORIGIN OF CATARRH, IN WHICH IT IS SHOWN THAT IT DOES NOT ISSUE FROM THE BRAIN."

Quorum igitur sanguis valde putridus diuque corruptis est, aut extraneo & venenato fermento pentissime imbutus, tum quibus viscera inquinata & labefactata sunt, prout in scorbuto, lue venera, lepra, veneno, aut morbo aliquo diuturno & putrido infectis pas-

It is not assumed from this that the blood of all animals is compatible, nor is it conceded that the remedy is so useful that an ill-advised or inopportune administration of it will not incur ill repute. I will briefly list a few of the indications for transfusion.

In those whose blood is exceedingly putrid and foul, or in whom it becomes completely saturated with extraneous ferments and poisons, or in whom their tissues are polluted and weakened, especially from scurvy, syphilis, leprosy, poisoning, or other chronic illnesses where the tissues are wasted everywhere, much improvement from transfusion is not to be expected.

sim accidit, non est quod veneficium aliquod aut juvamen ex transfusione exspectent.

Nimirum impurus sanguis repetito per viscera transitu vitia atque inquinamenta sua iis affigit, fermenta eorum corrumpit, & tandem propria qualitate ac indole ita imbuit, ut novus aliunde e quocunque licet sano animali substitutus, dam per easdem partes continuo circuletur, contracta labe in eandem diathesin cito degenerabit, non aliter quam vinum à mucido vase odorem & vitium mox contrahit.

Sincerum nisi vas, quodcunque infundis acescit.

Verum è corporibus vene constitutis si forte importuna venae sectione, illato vulnere aut quacunque demum haemorrhagia, sanguis ea copia detractus aut deperditus sit ut subsidium aliunde praesentaneum requirat; nullus dubito quin brutorum sanguis in ammissi locum secure possit & cum fructu substitui. Quinetiam in arthriticis & maniacis, quorum corpora robusta, firma vicera, & cerebri crasis nondum vitiata, quin & sanguis nulla putredinis labe infectus est, fortassis non minus beneficium ex recentis sanguinis infusione quam veteris detractione sperandum est.

Quamobrem ut majore hominum fiducia & operandi consuetudine celeberrimi hujus experimenti usus confirmetur, atque utilitas innotescat; mihi profecto res visa est non indigna quae medicorum omnium curae & ubicunque experiundi occasio sese obtulerit, universo orbi commendetur.

Interim hoc saltem Gentis nostrae seu felicitati, seu etiam laudi tribuatur, quod uti *Harveius* sanguinem intra propria vasa *circulantem* corpori suo vitam praestare primo docuerit: Ita & eum extra corporis sui ambitum ad alterius salutem *transferri* posse a nobis primo detectum est.

Without doubt blood becomes impure by absorbing ferments during its repeated circulation through vitiated organs, the ferments of which destroy it, and thus it becomes contaminated with any particular diseased condition present. If such blood is used on a healthy animal and allowed to circulate through its body the animal will contract the disease and quickly sicken, in the same way that wine will become odorous from mouldy containers and soon spoil.

Unless a clean dish is used, whatever is poured into it sours.

When a vein is severed by accident or inflicted wounds, or when simple hemorrhage results in such a great loss of blood that succor from some source is demanded in the emergency, there is no doubt but that the blood of an animal could be allowed to slip in and substitute in its place to advantage. But in the case of the arthritics and the maniacs whose robust bodies, sound organs and dense brains have not yet become vitiated, and in whom the blood has not become infected with putrid poisons, possibly no less benefit may be expected from the new blood transfusion than from the older purgative treatment.[2]

In order that men may acquire greater confidence in the application of this famous experiment and its usage become known, it has not seemed to me to be out of place to recommend it to physicians the world over as a treatment to be used whenever the occasion presented itself.

At least it is a comfort to our Nation and a credit to our fame that Harvey became preeminent by first demonstrating that blood circulated in the vessels inside the body. That this circulation could be extended outside the body was first discovered by me.

Notes

[1] See, "Diary of Samuel Pepys," November 14th, 1666. "To the Pope's Head, where all the Houblons were, and Dr. Croone. Dr. Croone told me, that, at the meeting at Gresham College to-night, which it seems, they now have every Wednesday again, there was a pretty experiment of the blood of one dog let out, till he died, into the body of another on one side, while all his own ran out on the other side. The first died upon the place, and the other very well, and likely to do well. This did give occasion to many pretty wishes, as of the blood of a Quaker to be let into an Archbishop, and such like; but, as Dr.

Croone says, may, if it takes, be of mighty use to a man's health, for the amending of bad blood by borrowing from a better body."

[2] "Diary of Samuel Pepys," November 21st, 1667. [It will be noted that this quotation is dated a year later than the former one.] "With Creed to a tavern, where Dean Wilkins and others: and good discourse; among the rest, of a man that is a little frantic, that hath been a kind of a minister, Dr. Wilkins saying that he hath read for him in his church, that is poor and a debauched man, that the College have hired for 20s. to have some of the blood of a sheep let into his body; and it is to be done on Saturday next. They propose to let in about twelve ounces; which, they compute, is what will be let in in a minute's time by a watch. On this occasion Dr. Whistler told a pretty story related by Muffet, a good author, of Dr. Caius, that built Caius College; that, being very old, and living at that time upon woman's milk, he, while he fed upon the milk of an angry, fretful woman, was so himself; and then, being advised to take it of a good-natured, patient woman, he did become so, beyond the common temper of his age. Their discourse was very fine; and if I should be put out of my office, I do take great content in the liberty I shall be at, of frequenting these gentlemen's company."

November 30th, 1667. "I was pleased to see the person who had his blood taken out. He speaks well, and did thus give the Society a relation thereof in Latin, saying that he finds himself much better since, and as a new man, but he is cracked a little in his head, though he speaks very reasonably, and very well. He had but 20s. for his suffering it, and is to have the same again tried upon him: the first sound man that ever had it tried upon him in England, and but one we hear of in France."

PREFATORY ESSAY TO AN INTRODUCTION TO THE STUDY OF PHYSIC BY WILLIAM HEBERDEN M.D.

By LE ROY CRUMMER, M.D.

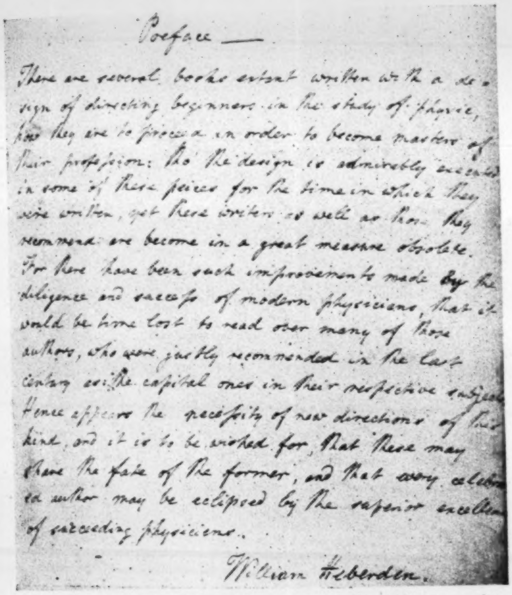
OMAHA

THERE are many methods of acquiring rare books, but the most interesting is the search for "nuggets" in the smaller secondhand shops. If time is of value, this method is not to be recommended, but if the pleasure of pursuit is an object, it certainly has its fascination. Even some of the leading booksellers are given to this in connection with other ways of securing stock, and are prone to boast more of such finds than of greater books acquired in other trade channels. Such a "nugget" was my Heberden manuscripts.

There is a little shop in the south of London, more or less famous for its "curiosa" and oddments of the printed page. In the catalogs occasionally issued by the owner of this shop are frequently recorded almost forgotten trifles both of type and manuscript, which fitted properly in place round out a collector's desire or a student's need. From such a catalog, a friend of mine secured a student's notebook of the lectures of a famous surgeon, which gave a new light on his methods, and served to increase his already outstanding reputation. This shop has a sixpenny bin out in front; within are many shelves filled with the nondescript in literature, but in a room upstairs—never penetrated by customers—may be treasures. The proprietor is of the second, perhaps of the third, generation of booksellers, whose traditions are so firmly established that the details of a visit become a routine, nay, almost a ceremony. May I describe it? You enter; greetings are exchanged. You wander around the room, take down a shilling item, pass to the half-crown shelves, take down another book or two, perhaps worth while; at any rate, it is a part of the ceremony to lay such books aside—then the direct inquiry, "What have you in my line?" The latest catalog is produced, usually months old, and 90 per cent sold.

You sit down and study it, check an item, and if not sold, a quick trip upstairs and the bookseller brings down the book and lays it on the table before you. Usually half a dozen maneuvers of this kind are necessary, for this dealer shows the items secured for the next catalog only with the utmost reluctance. Cigarettes are passed, conversation begins, you speak of the interesting books ordered from previous catalogs; he speaks of the difficulty of securing stock nowadays—says books are getting scarcer—becoming harder to find, almost disappearing; he tells of the great things that have passed through his hands in the past. You become a little insistent and say that he must have something you want which he has not cataloged; he tells another story. Then, if the ceremony has been properly carried out and is diplomatically successful, he may exclaim as if it had just come into his mind, "I have something you might be interested in." Another trip to the mysterious region above, and he brings down what he knows you have wanted from the moment you entered the shop.

On my last visit the negotiations proceeded in this order, now retarded, now advanced, by a book scout who was present, and the climax, somewhat delayed, was this remark: "I did pick up some manuscripts in Wales last week which may be medical." Returning from another trip upstairs, he laid before me three volumes of manuscript. A casual inspection, then a start; one volume had written on the title page, "An Introduction to the Study of Physic," and below a holograph preface was the signature, "William Heberden." The shilling and half-crown books were sent by post, but the manuscripts were taken from the shop under my arm. An evening's study proved the interest of the contents, and even while reading, many problems fluttered through my mind; "Are they genuine; are they in Heberden's handwriting; has the material been published; are they important?"



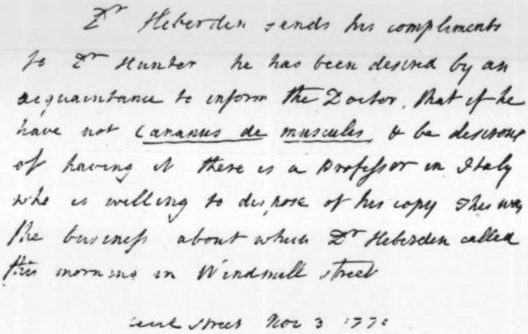
Preface —

There are several books extant written with a de-
sign of directing beginners in the study of physic,
how they are to proceed in order to become masters of
their profession: tho' the design is admirably executed
in some of these peices for the time in which they
were written, yet these writers as well as those they
recommend are become in a great measure obsolete.
For there have been such improvements made by the
diligence and success of modern physicians, that it
would be time lost to read over many of those
authors, who were justly recommended in the last
century as the capital ones in their respective subjec
Hence appears the necessity of new directions of thi
kind, and it is to be wished for, that these may
share the fate of the former, and that every celeb
ed author may be eclipsed by the superior excelle
of succeeding physicians.

William Heberden.

FIG. 1. FACSIMILE OF THE PREFACE IN DR. HEBERDEN'S HANDWRITING.

The next morning I took the manuscripts to the Royal Society of Medicine, knowing that I could rely upon Mr. Powell, the librarian, to direct me in my quest. A search of the catalogs, indices and bibliographies showed no similar title, and in a study of the available biographies no mention of any such essay was found; but the facsimile signature of Heberden under the portrait in "Pettigrew's Medical Portrait Gallery," seemed identical with that of the manuscript. A day or two later I went to the Royal College of Surgeons with Dr. Harvey Cushing, in search of further information. While Dr. Cushing was visiting with Sir Arthur Keith, Mr. Thompson took me to the library where Mr. Plau sought Heberden holographs. This letter, in a script similar to that of my manuscript, was found in the Matthew Baillie collection of autographs:



Dr Heberden sends his compliments
to Dr Hunter he has been desired by an
acquaintance to inform the Doctor, that if he
have not Cananus de musculis & be desirous
of having it there is a professor in Italy
who is willing to dispose of his copy This was
the business about which Dr Heberden called
this morning in Windmill street

Cecil street Nov 3 1770

FIG. 2. FACSIMILE OF DR. HEBERDEN'S LETTER TO DR. HUNTER.

Dr. Heberden sends his compliments to Dr. Hunter; he has been desired by an acquaintance to inform the Doctor, that if he have not *Cananus de musculis*, & be desirous of having it there is a professor in Italy who is willing to dispose of his copy. This was the business about which Dr Heberden called this morning in Windmill street.
Cecil Street Nov 3, 1770.

By a strange coincidence, Dr. Cushing and I each own one of the thirteen known copies of "Musculorum humani corporis," of Canneo, and both copies, though purchased from different booksellers in Italy, came from the same Italian professor.

On another day I sought further confirmation at the Royal College of Physicians. Dr. Chaplin was not there, but Mr. H. M. Barlow, courteous as always, found the absolute proof for me. The minute I showed him the manuscripts he said he knew Heberden's handwriting, and that these were in his hand. He then sent an assistant to the vault for the original manuscript volumes of Heberden's "Commentarii." These two volumes are written in Latin, each containing about the same material. The volume date in pencil, "22 Maii, 1784," is the final revision and the one used by the younger Heberden for publication and translation. These had been given to the College by William Heberden, Jr., who had written in a trembling script on the flyleaf of the first volume, "It is particularly requested that this book may on no account be taken out of the College, to whom it is presented by his son, W. Heberden." Just above, written by the senior Heberden, was this illuminating sentence: "I desire that this book may be given to any one of my sons, who applies to the study of physic. W. H."

In the other volume equally interesting notes are found. The senior Heberden has written "I desire that this book may be given to Mrs. Heberden for the use of any of our sons who shall study Physic. W. H." Just below this characteristic sentence the son has written "This & the english copy wch is in London have been collated, & they agree with one another & with the latin copy."

These volumes are fresh and immaculate and written throughout in the beautiful script of William Heberden, which was so characteristic that Mr. Barlow identified the writing in my volumes at a single glance. Equally striking was the fact that the make-up of these volumes—the paper, the quire arrangement, the format and the limp vellum binding—was identical with the three volumes I had found.

So, justified in my belief that my manuscript was an unpublished work of Heberden, I began to study the biographies, only to find that his greatness was more a matter of assumption than of exact record. As Davidson remarks in his essay on Heberden:

> Very few men whose outstanding claims for greatness are those bound up with personality, live on, for there are few Boswells to leave readable accurate accounts of their lives. Heberden had no such biographer.

The early 19th century memoirs contain only the significant dates and events with a few constantly recurring anecdotes. The character estimates, as was customary in this none too brilliant period of literature, consisted of an attempt to use as many as possible of the favorable adjectives and adverbs without any particular discrimination, and certainly without creating any mental picture of the man who was so important in his public, professional and personal relationships, and whose few

FIG. 3. ST. JOHN'S COLLEGE.

printed works reveal him as such an outstanding figure in rational medicine. In brief:*

> William Heberden, the elder (1710–1801) B.A. St. John's College, Cambridge, 1728; senior fellow, 1749: M.D. 1739, F.R.C.P., 1746; Gulstonian (1749) and Croonian Lecturer (1760); Harveian Orator (1750) and censor, F.R.S. 1749; practiced in London from 1748; first described *angina pectoris;* attended Johnson, Cowper and Warburton. His works (edited in Germany by Soemmering) include, 'Commentarii de Morborum Historiâ et Curatione, 'and contributions to 'Transactions' of the College of Physicians and Royal Society.

Such is the concise record of Heberden, who, in the preface to the posthumously published "Commentarii," probably the most popular book on medicine in the first part of the 19th century, justified its publication, or perhaps more properly speaking, gave as his inspiration this translation:

> Plutarch says, that the life of the vestal virgin was divided into three portions; in the first of which, she learned the duties of her profession, in the second, she practiced them, and in the third, she taught them to others. This is no bad model for the life of a physician; And as I have now passed through the first two of these times, I am willing to employ the remainder of my days in teaching what I know to any of my sons who may choose the profession of physic: and to him I desire these papers may be given.

Since his book has been paid the highest compliment, not only by his contemporaries but by each succeeding generation of students interested in the evolution of the basic idea of the application of medical thought, it is still worth close study. This book remains the expression of Heberden's mode of thought, the effect of his study, his method of practice and his direct application of knowledge to the benefit of his own patients, as well as to the larger object, the dissemination of medical knowledge.

Between the lines of his theses may be read the keen intellect which refused to accept the hundred and one theoretical, fanciful plans of the systematists who dominated medicine in the 18th century. In his descriptions of disease may be seen the keen, trained, logical power of observation for which, before him, Hippocrates and Sydenham had been famous. This basic method of medicine has been sporadically manifest throughout the development of the art, only to be constantly displaced by the urge to create a fundamental philosophical system which would render practice less arduous, since the mind need know only a method in which argument would supplant effort, and need not hold the numerous essential facts, which, after all, represent the sum total of our medical art, even a century and a quarter after Heberden.

The "Commentarii" was not published until after the author's death, but the final draft, founded on his repeated bedside observations, and constantly revised in the light of freshly acquired experiences, was finished not later than 1782. This manuscript, as mentioned above, is now in the Library of the Royal College of Physicians. It represents the most careful analysis of the professional experiences of over forty years of active practice, thirty of which were spent in London at a period renowned in the development of English medicine, and made brilliant after the century of professional inertia following Sydenham, by a group of men who made London the center of the medical world. Chaplin has covered this particular period in his "Medicine in England during the Reign of George III," giving proper praise to Heberden. It may be noted that among his colleagues and friends were John and William Hunter, Fothergill, Jenner, Sir George Baker, Witherington, Pitcairn and Robert Gooch, men who in point of time followed Heberden, and bridged the road to the development of the great group headed by Richard Bright.

It is difficult to understand why the manuscript was not published by the author in the twenty years after the date of the preface, May, 1784. I like to think that in his dignity and simplicity he truly believed in the Hippocratic creed; that his work was primarily for his sons, as he said in his preface and repeated in the final note on the flyleaf. In one of my other volumes of manuscript notes, there is carefully copied an essay "Upon Composition, Authors, and their works in general, either of Genius or Science." A few quotations from this essay may show why the "Commentarii" was not published by the author:

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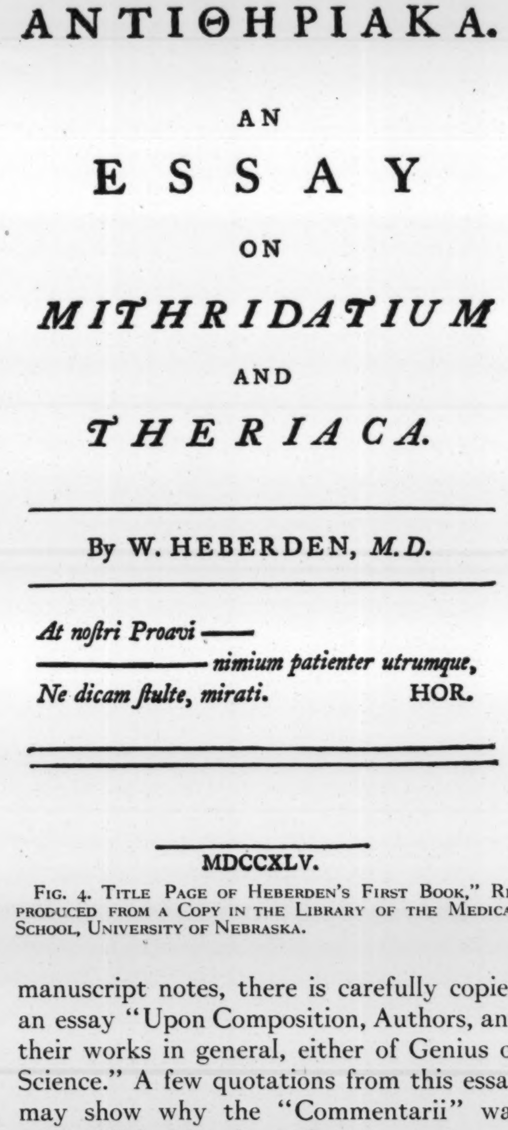
*The Concise Dictionary of National Biography, London, 1919.



ANTIΘHPIAKA.

AN

ESSAY

ON

MITHRIDATIUM

AND

THERIACA.

By W. HEBERDEN, *M.D.*

At noſtri Proavi ——
—————— nimium patienter utrumque,
Ne dicam ſtulte, mirati. HOR.

MDCCXLV.

FIG. 4. TITLE PAGE OF HEBERDEN'S FIRST BOOK," REPRODUCED FROM A COPY IN THE LIBRARY OF THE MEDICAL SCHOOL, UNIVERSITY OF NEBRASKA.

> If men of letters could be obliged to write always with a view to publishing, though without ever doing so, they would be perhaps the happiest of men . . .
>
> Commonly, a man who has already established a reputation, loses it as soon as he ventures to give anything to the public. . . .
>
> The exercise of composition opens and enlarges the mind and improves the taste. . . .
>
> It might possibly be better to do the contrary, to read rather than write, at least than to publish.
>
> Good readers are almost as rare as good authors. Good authors we may say are only for good readers.

The possession of such ideas affords consistent explanation of Heberden's failure to publish his "Commentarii." He wrote for his sons alone, one of whom became a physician, and, appreciating the importance of his father's work, not only published the Latin original, but himself translated the book and issued an edition in English.

The same form of literary restraint is shown in the scarcity of his contributions to journalistic literature. Only twenty articles by him are cited in the bibliography given in the "Lives of British Physicians." Of these the first, "Antitheriaca," was published while he was still at Cambridge. This short essay required a tremendous amount of study and investigation, since the origin of mithridate and theriaca was buried in the mysteries of a legendary past, and the combination of these fanciful drugs changing constantly from century to century had been evidence of the evolution of pharmaceutical superstition. The preparation of mithridate and theriaca, noted in the first edition of the "London Pharmacopeia" (1618) was the gauge of craftsmanship of the apothecaries, and skill in preparation was a frequent advertising slogan with members of the guild. Heberden's analysis was so successful, however, that these glamorous drugs lost their superstitious attributes.

"It is a strange play of fortune that Heberden was remembered by many generations of medical students by virtue of a bizzare formula which the undergraduates called "Heberden's ink." Originated by Heberden about 1760, it became official in the Dublin Pharmacopeia in 1826 under the title *Mistura Ferri Aromatica*. Barker's translation of this edition gives the following formula:

AROMATIC MIXTURE OF IRON

Take of Lance-Leaved Cinchona, reduced to coarse powder, an ounce,

Colomba Root, sliced, three drachms,

Cloves bruised, two drachms.

Iron Filings, half an ounce.

Digest for three days in a closed vessel, shaking occasionally, with as much peppermint water as will be sufficient, to afford twelve ounces of strained liquor, then add

Compound Tincture of Cardamon's, three ounces,

Tincture of Orange Peel, three drachms.

This formula remained in the British Pharmacopeia until 1890, a period not as long as the duration of the belief in the "Antitheriaca," but it might be figured that the period of persistence of the two formulas was in direct relationship to their complexity.

Most of the other essays were contributed to "Medical Transactions" of which Heberden was more than sponsor. Indeed his "Sketch of a Preface Designed for Medical Transactions," 1767, and reprinted as an appendix in the English edition of his "Commentarii" is an elaboration of the hint given in Chapter 10 of "An Introduction to the Study of Physic." The plan thus outlined and elaborated seems to be the working basis for editing and publishing the "Transactions of the Royal College of Physicians," of which six volumes were issued between 1767 and 1820.

His "Disorder of the Breast" deserves the praise so freely given it, since it presents such a well-drawn word picture in this, the original description of angina pectoris, that both the name and the theory were immediately accepted by the leading minds of the profession. Jenner's letter to Heberden about John Hunter's case, almost as well known and important is evidence of this acceptance. His other original communications are of less significance, but they reflect his power of acute clinical observation, constantly checked by the tenacity of his personal methods, as outlined in the preface to his "Commentarii" of which further evidence is found in almost every page of his "An Introduction to the Study of Physic."

But these few essays are not sufficient to account for his reputation, nor is the popularity of the posthumously published "Commentarii" an explanation of the influence he exercised both professionally and publicly during his half century in London. Heberden must have been an individual who radiated the best type of influence by a personality which charmed his colleagues and his patients of all types. Unfortunately such influence leaves but little record, and is therefore difficult to estimate.

His biographers have repeated an occasional anecdote, and all report his friendship with Middleton; his attendance in the final illness of Samuel Johnson, and Boswell's comments; his recommendation of Dr. Letherland, when his own interests caused him to decline the appointment as Physician to the Queen; his resolve to retire at a certain age on noting the infirmities of age in Doctor Mead, when they met in consultation. His association with Franklin has been described by Pepper and Cushing, both, however, from the Franklin side of the discussion.

These are remarkably few facts to have been left from a period of fifty years of active practice in the last half of the 18th century, and even these illustrative anecdotes may be of the "cherry tree" variety, and allow an entirely different interpretation from that given by his biographers.

There is a story that he bought, in order to destroy it, a skeptical work, left in manuscript by Dr. Conyers Middleton, and that he paid Dr. Middleton's widow two hundred pounds for it, although a publisher had offered but one hundred and fifty. This seems to me to be capable of a more consistent explanation. I would rather think that Heberden's action sprang from true friendship, and that piety was an excuse to placate Middleton's widow. This friendship dated from Heberden's Cambridge days, and that it was a sincere and mutual one is shown by the laudatory Latin dedication to Middleton by Heberden on the preliminary page of "An Introduction to the Study of Physic." Middleton died in 1750, a very short time after Heberden had removed to London, so that the gift to Middleton's widow seems to me all the more gracious. This Latin dedication must be considered also in attempting to establish the time when Heberden wrote the "Introduction." The same graciousness perhaps explains the recorded intimacy of Heberden and Franklin, though greater men than the former have yielded to the diplomacy of the latter. The fact that Franklin induced Heberden to print and publish at his own expense "Introduction in Inoculation for use in the Colonies" is interesting, but how much more interest would be found in a verbatim report of the considerations and conferences between Franklin and Heberden, which led to the publication of this very interesting pamphlet!

The Letherland incident is thus given in the "Lives of British Physicians" (p. 202):

> He had an opportunity of rendering an essential service to Dr. Letherland, a man of deep and very extensive learning, but of retired habits, and very little known even in his own profession, although he contributed, by his literary information, to the popularity of more than one of his colleagues. Dr. Heberden's extensive practice made it inconvenient for him to accept the appointment of Physician to the Queen; and the King, who had always shown toward him the greatest esteem and regard, readily adopted his disinterested recommendation of Dr. Letherland as his substitute in the situation.

The rejection of such an appointment, so highly regarded by most of the profession then and now, calls attention to Heberden's attitude toward those positions of trust and honor which make up such a large part of a physician's activities. He seems to have made no hospital connection in London; he is not mentioned in association with the dispensaries of which so many were founded in London during the latter years of Heberden's life, nor did he offer in any way private lectures on medical subjects, as did so many of his colleagues. Such an attitude toward official position may be the real reason which induced Heberden to decline the appointment of Physician to the Queen.

This modesty is equally apparent in his association with the Royal College of Physicians, and his list of honors within the Society is very meager compared with that of many of his colleagues; particularly so if the comparison embraces men of equal standing before and after his time. His association with the Royal Society began soon after he moved to London, and his early communications were made to its transactions, but after he began to take so much interest in the transactions of the College of Physicians there is record of only one further communication to the Royal Society. In a period when complimentary membership in scientific societies was the usual mark of appreciation, Heberden accepted only one such distinction; that, however, the best: in 1778, he was elected Honorary Member of the Royal Society of Medicine in Paris.

There is always interest in the homes of famous persons and the modern visitor to London must wonder how Harvey could get back and forth between Roehampton and Westminster, and how much time John Hunter lost in his trips between Earls Court and Leicester Square. Heberden had even more of a task as his country place was at Windsor while his London residence was for a time on Cecil Street as his letter to William Hunter shows. The London directory of 1795 shows him living at 79 Pall Mall, not the same house, but the same address as the residence given to Nell Gwynne by Charles II.

Heberden's biographers always quote from Boswell: "Dr. Johnson, being asked in his last illness, what physician he had sent for, replied, 'Dr. Heberden, *ultimus Romanorum*, the last of our learned physicians.' "

This compliment, richly deserved though it was, reminds one, as do many of Boswell's stories, of the dying speeches of the heroes of our second readers which, psychologically considered, belong to the justification type of might-have-been retorts, which anyone can make up so well the day after. According to Dr. Chaplin, Johnson also referred to Heberden as *timidorum timidissimus*, which now may be considered a badge of praise rather than censure, since it defines Heberden's sound judgment in a conflicting period when treatment was nothing if not heroic.

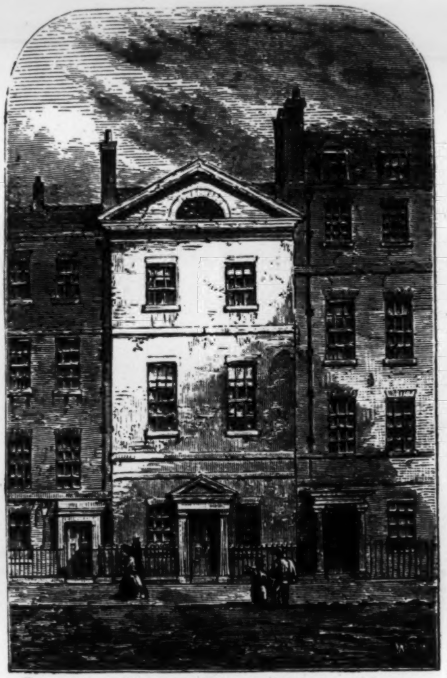


FIG. 5. NELL GWYNNE'S HOUSE, 1820, OCCUPIED BY HEBERDEN, 1795.

But enough of these anecdotes which make up so much of the conventional biographies of Heberden. In spite of the meagerness of recorded details, his influence in English medicine has been beyond measure, and justifies this tribute paid by Sir William Osler, in his Lumleian Lecture of 1910:*

I make no apology for the subject I have chosen—Angina Pectoris. In a very special way it is *our* disease, having been first fully described at this College by the English Celsus, William Heberden, and in a manner so graphic and complete as to compel the admiration and envy of all subsequent writers. Like books, diseases have their destiny. Could Heberden return for a month's busy practice his surprise would not be less at the new cohorts of disease than at the disappearance of familiar enemies. How staggered he would be at the *Nomenclature* of the College. And he would be keen to write new commentaries upon old diseases with new names. How the word appendicitis would jar his critical ear, and how rejoiced he would be to see light on the dark malady, "inflammation of the bowels." Living through a century of theory, he died at the outset of the great awakening in clinical medicine, bequeathing a precious legacy of experience greatly appreciated by several generations of students, and leaving in this College a precious memory which it is our delight to cherish.

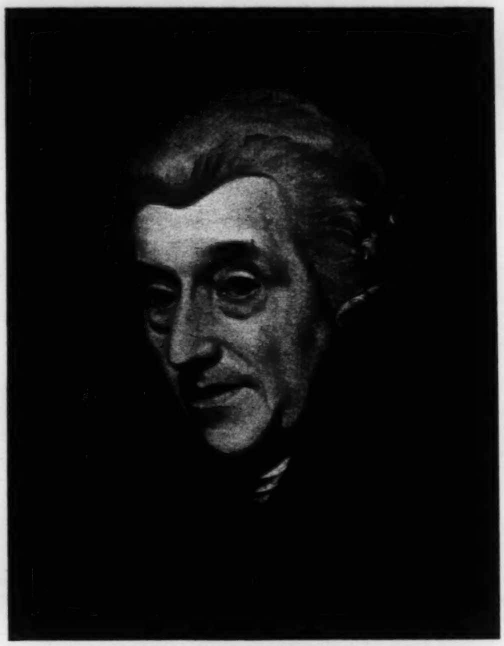


FIG. 6. WILLIAM HEBERDEN

Looking through the famous "Commentaries," one is impressed with the value, with the rarity too, of the old-fashioned, plain objective description of disease; and one is impressed also with the great gulf which separates the clinical medicine of today from that of our great-grandfathers. Page after page of the "Commentaries" are as arid as those of Cullen or Boerhaave, and then we light upon an imperishable gem in the brilliant setting of a master workman, whose kinship we recognize with the great of old—with Hippocrates, with Aretaeus, and Sydenham. Such a clinical gem is the account which Heberden read at the College, July 21st, 1768, "Of a Disorder of the Breast" to which he gave the name "Angina Pectoris," based on the study of twenty cases. When he incorporated the description in his "Commentaries" (written in 1782) his experience had extended to 100 cases.

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* Cushing, H. Life of Sir William Osler. London, Oxford Univ. Press, 1925, II, 212.

Very few of Heberden's manuscripts have survived. As already mentioned, the original Latin manuscript of the "Commentarii" is preserved in the Royal College of Physicians. This library also has the manuscript of his Goulstonian Lecture of 1749. Dobson says of the lectures on materia medica: "They have never been printed although they were or are still existant in manuscript form." Dobson probably here means the manuscript elsewhere referred to as being in the Library of Trinity College, Cambridge. Some of his letters are preserved in the British Museum and the Royal College of Surgeons. To this short list may be added the three volumes of manuscripts which I found in South London in 1927.

The material in these three volumes throws no new light on the details of his life, but confirms the indication given in the "Commentarii" of his methods of work, and fills in the details of a broad picture of a man intensely interested in the practical side of medicine. The moral essays and the translations found in one of these volumes are a revelation of his interests and mode of thought outside of medical chanels. The volume on strictly medical subjects, which must antedate by many years his final opinions as expressed in the "Commentarii," shows his power of observation, assimilation and constructive thought in matters medical; the other volume, "An Introduction to the Study of Physic," is of such special interest that it has been deemed worthy of reproduction.

Two of the three volumes of manuscripts were of uniform size, 6½ by 8 inches, bound in vellum; the third volume is approximately the same size, bound in quarter calf. The water marks differ in all three, and there is an irregularity in the number of quires, one having, for instance, twenty-four and another sixteen, which indicates that these were special orders made up by some blank book manufacturer. Each volume has between two and three hundred pages. The writing is for the most part in Heberden's hand, though an occasional essay is written in a different script, probably the work of an amanuensis.

One volume contains many chapters with titles identical with those in the "Commentarii" as finally published. It begins with a preface headed, "Preliminary Observations," which is followed by chapters on: "Dropsy, Spasmodic diseases, Hysteria, Epilepsy, Tentaneus, Apoplexy, Palsy, Gout, Jaundice, Scrofla, Scurvy, Cutaneous eruptions, Calcareous concretions, Signs of pregnancy."

Each of these various chapters seems to have been written primarily under the inspiration of a striking case, since the clinical descriptions are so accurate and attempts at treatment are so conscientiously detailed. These essays however were probably not his original ideas, as attempts at modification or classification are apparent throughout, nor were these essays directly transposed to the final book as published, nor are they the statement of his final judgment. It is rather difficult to find direct quotations for comparison, but in his manuscript notes in describing mania, he says:

> It has been thought that in certain habits, the moon has the power of inducing paroxysms of mania. The moon is not at such a distance as to be supposed incapable of affecting our bodies; and there have been evident instances of the pulse becoming harder, fuller and stronger under certain phazes, and there are certainly some

well attested cases, tho' these are very rare, of parozysms being affected by the moon.

While his final judgment as expressed in the "Commentarii" is quite to the contrary:

> It is an inveterate opinion, which my experience has uniformly contradicted, that madness is influenced by the moon.

In this particular volume there is concrete evidence that Heberden pursued the method he so strongly recommends of constantly making and revising his clinical notes, and this volume is probably the only one which has survived of many similar notebooks in which he recorded the results and judgments of his vast clinical work.

In another volume there is a miscellany of essays and translations most of which are not of a medical character, although a chapter headed, "The Pandora of Insects" is followed by his own translation of "The Living Efflorescences" by John C. Nyander, Upsala, June 23rd, 1657, and "Of the Cause of Intermittent Fevers, a New Hypothesis," by Linnaeus, under date of 1735. The chapter headings in this volume serve as an index of the diversity of Heberden's interests:

> On the Talent of Speaking and that of Writing;
> Upon Composition, Authors, and their works in general, either of Genius or Science;
> Of Raillery;
> Of Advice;
> Of Simplicity; And the different kinds of Modesty.
> Of the Effect of Habit, Self Love and Modesty;
> Why the sight of those whom we have offended is disagreeable to us;
> Of the Great;
> The Pandora of Insects;
> The Vegetable Kingdom;
> Of Drinking Cofee;
> Of Drinking Tea;
> Of the Increase of the Habitable Earth;
> The First Phillipic of Demonsthanes."

The third volume shows much more evidence of use than do the others. Written on the recto of seventy-four pages is the manuscript of "An Introduction to the Study of Physic." In a different hand throughout the remaining blank pages and on the verso of some of these seventy-four pages are notes, all of which may be connected into a study of the impurities of drinking water. There are many tables of chemical formulae and laboratory experiments with notes concerning the source of supply of the various waters tested, including a table headed, "Leaden Pumps, Cambridge." There are also two title headings: "Notes for Leamington Water" and "Cases of Diseases from Water Impregnated with Lead." One very interesting detail is a paragraph headed: "Extract of a private letter from Sir G. Baker to Dr. Heberden, Jr."

These various notes, formulae and chapter headings give understanding to the autograph written in the front of the book: "William Lambe, Coll. Div. Joann. Cant." William Lambe (1765–1846) received his B.D. from St. John's College, Cambridge, in 1786; M.B. in 1789, and M.D. in 1802. He was admitted a Fellow of his College in 1788. William Heberden, Jr., two years younger than Lambe, was also a Fellow of St. John's College, from 1788 to 1796. So it is quite probable that Lambe and Heberden, Jr. were friends, and possible that through the junior Heberden, to whom his father had given this volume, the manuscript came into Lambe's possession.

Lambe's chief contributions to medical knowledge were his analysis of the Leamington Water, 1790, and "Researches into the properties of Spring Water with Medical causations against the use of Lead in Water Pipes, Pumps, Cisterns. etc.," 1803. Lambe was admitted a Fellow of the College of Physicians in 1804, and was Harveian Orator in 1818.

I think this manuscript must have been written in the latter part of Heberden's Cambridge period, or at least in the early years of his life in London (1744–1755). There is no date recorded in the manuscript itself, nor any direct citation of current events which would definitely place the year or years of its composition. There are references to one hundred fourteen texts in the manuscript, but to only a few is the date of publication appended, in each instance to a year in the 1730's. Boerhaave, so frequently mentioned and so highly commended, reached the height of his popularity about 1730.

Speaking of Lindenius Renovatus ("Scriptus Medicus," libri duo, etc.) he says: "The other fault is self-evident, which must of course attend a book of this sort published about 50 years ago." Since the edition of Van der Linden was published in 1686, it would seem that Heberden might be writing in 1736, but considerable license must be allowed in such expression and no exact arithmetical conclusion should be drawn.

In Chapter 7 Heberden says:

> The physiology of Boerhaave's institutions has lately been published separate under the name of oeconomia animalis with copies of the plates to which he refers, and these are the best, that are scattered among all the anatomical writers, etc.

This translation into English under the title of "Oeconomia Animalis" was first published in London in 1741.

At the end of Chapter 4 there is a statement which may be considered in point of date. Heberden says: "This work of Geoffroy which is in 3 vol., 8vo. is not yet compleat." But there were several editions of this work: "Tractatus de Materia Medica," 3 vols., Paris, 1741, was the original. It was translated, epitomized, abridged and issued in various forms in the different years. Heberden very probably referred to the Latin edition in three volumes with two parts to Volume II, London, 1756–1760.

On one of the preliminary leaves of the manuscript is an encomium of Conyers Middleton who died in 1750; so that the manuscript must have been well in hand before that date. This form of praise was very common in books throughout the 18th century, but was supposed to be written after only having seen the manuscript. There can be no question that this paean of Middleton referred to "An Introduction to the Study of Physic," which must have been in almost final form before Middleton's death in 1750. While these dates gathered from internal evidence run from as early as 1736 to as late as 1756, they are not essentially contradictory when Heberden's custom of writing, rewriting and rearranging his material is considered. Thus I think it fair to assume that the original idea was formed while he was teaching at Cambridge, that the material was finally revised during his early years in London, and that the final form represents Heberden's plan for a proper arrangement of the medical curriculum at the end of his experience in teaching in Cambridge.

This particular period is rather significant in the history of English medicine. The year 1745 happens to be the year of the separation of the Surgeons from the Guild of Barber Surgeons, and the establishment of the Company of Surgeons, the first independent venture of the British Surgeons which lasted, however, only until 1800, when by another royal charter the present Royal College of Surgeons was established. Heberden's years of study and teaching in Cambridge had extended from 1724 to 1749, and in these years the dispute between the physicians and the apothecaries had been solved to the advantage of the apothecaries, thus leaving the practice of physic in England, especially in London, in a state of disorganization which persisted for a long time. Retrospective survey would indicate that this particular time was an auspicious one for someone interested in education to attempt to stabilize methods of teaching. Heberden, who no doubt himself experienced the difficulties of obtaining a proper training in Cambridge and London (for there is no record of his visiting any Continental Universities) had further opportunity to see and try to surmount the difficulties during the years of his Fellowship in Cambridge, where he must have acted at least in an advisory capacity to the younger students who hoped to take up the study of medicine.

At this period, the original opposed methods of medical training had by no means been fused into our modern concept of the medical school. A great deal of knowledge of the care of the sick had been derived from the lower orders of barber surgeons, herbalists and wise women, who by tradition and rule of thumb observation had evolved methods of treatment sufficient for the needs of the mass of the people: It is surprising how many of our accepted and established principles of medicine came from these sources. In England, traditional folk medicine had produced two types of practitioner, each with recognized standing: the surgeon and the apothecary. In London, especially sustained by Guild traditions, the surgeon no longer a barber surgeon, and the apothecary no longer a druggist or a grocer, were in active professional charge of the ills of a very large proportion of the people. In these guilds apprenticeship was the foundation of training, supplemented in the case of the barber surgeon by public anatomies under the Gale and Arris foundations, and in the case of the apothecaries by certain forms of practical instruction from the Master of the Apothecaries. Apprenticeship may be considered not only the foundation of the medical guilds, but also the basis of other guilds which made London so famous as a commercial center of this and the preceding century. The influence of apprenticeship in medicine was so strong that its echoes still reverberate in any modern discussion of medical training.

Quite beyond and apart from the surgeon and the apothecary stood the learned Doctor of Medicine. The educated physician, possessor of this degree obtained at one or the other of the two great Universities in England, was also sustained by strong tradition and royal charter. While the Royal College of Physicians had jurisdiction only over London and its immediate environs, custom and precedent had determined that Fellowship could be bestowed only on those holding a degree from Oxford or Cambridge; the graduates of foreign universities could have all the extracorporeal privileges as of the College under the designation of Licentiate. Even to a much later time the Universities of Oxford and Cambridge retained the medieval scholastic traditions in regard to the importance and significance of granting degrees, although the constituent colleges of neither university provided the proper facilities for earning the degree of M.D., or even M.B. By academic rule, eleven to fourteen years had to be spent in the Universities before the degree of Doctor of Medicine could be earned. Even traditional teaching of classic medicine could not occupy a large portion of this extended period, and medicine tended to become a "minor" in obtaining this graduate degree. It is not surprising therefore that Fellows of the Royal College of Physicians in the first half of the 18th century achieved much more lasting fame in literature than in medicine.

In addition to earned degrees there were other methods of securing this coveted distinction; both Universities could confer the degree at command of the King or the Archbishop of Canterbury, and frequently did so. The Universities also had the power to incorporate the degree obtained at other Universities, usually on the Continent, but in modern political language, this required at least a certain amount of "pull." No matter how the degree was acquired, election as a Licentiate of the Royal College of Physicians almost immediately followed and in a year and a day the Fellowship was conferred.

The Licentiates of the Royal College of Physicians were composed of two groups: those who, having proper credentials, might expect their Fellowship in due course; and another and larger group of permanent Licentiates who had obtained their degree at other universities. In 1750 the Licentiates were usually graduates of Continental Universities, although later, after the great school at Edinburgh had begun to function, a majority of the Licentiates were from the northern institution.

Munk's "Roll of the Royal College of Physicians" throws many interesting side lights on these medical qualifications, but of especial interest is the fact that during the first half of the 18th century there was only an occasional election to the Fellowship. Chaplin has collated the figures from various scources, and has shown that during the second half of the 18th century there were annually less than two elections to Fellowships, and only about five Licentiates admitted. He quotes in 1746 but forty-one Fellows and twenty Licentiates in London, including the West End. Even forty years later, after the influx from the Northern Universities was well established, there were but twenty-six Fellows and fifty-one Licentiates among the seven hundred and seventy four recognized practitioners in London.

At the very same time that Heberden was writing his "Introduction" the general dissatisfaction in medical education was manifest in different quarters. In London medical education was just emerging from the apprenticeship stage and a few of the hospital physicians were beginning to teach personal students in the hospital wards. This method soon developed into a nepotism which persisted with increasing power until finally overthrown by Wakley and the Lancet. The real hospital schools in London were just beginning to function and even the private schools of anatomy, chemistry and materia medica, those remarkable developments of the latter half of the 18th century, made so effective by the great anatomical school in Great Windmill Street, were represented only by the efforts of the Douglas brothers in private instruction in anatomy.

In 1750, under Monro Primus, Edinburgh was just beginning its brilliant career as a primary center of medical education. The large army of peregrinating medical students was beginning to desert Leyden and the Continental Universities, and for the next half century was to flock to the northern capitol.

Written at such a period the "Introduction" may be regarded from two standpoints: one, the purely personal and the other, as an exhibit hitherto unrecorded in the general history of medical education.

Thus it would seem that in the "Introduction" Heberden has given an autobiographic survey of his own method of study, a list of authorities in his judgment most worth while and a criticism of antecedent medical literature based on an unequaled understanding of original texts.

In all the biographies of Heberden his knowledge of the classic languages is strongly emphasized. To achieve such distinction at a period when practically all scientific as well as medical observations were recorded in Latin signifies exceptional ability. Hence his comments on preceding medical literature become authoritative, as from one who had a complete understanding of the state of medical sciences of the time as well as an extraordinary ability in the language in which the original communication had been made. As a consequence of our present indolence in languages, our opinions are usually formed on translations at best, on excerpts and even on expressions from authors who may never have read the original. The test of time has to a great measure justified the choice of authorities. He mentions one hundred fourteen books by title, and of these only thirty are missing in the index of Garrison's "History of Medicine."

Heading the list of books recommended to the medical student are Le Clerc and Freind on the history of medicine. These two authorities were comparatively new at this time, but still hold their place as source material of great value. Heberden's interest in the history of medicine does not stop with his recommendation of these books, but throughout, in his analysis of authors, his criticisms are directed always from a broad historical understanding which includes not only the history of medicine, but to a great extent, especially with the ancients, a knowledge of both general history and contemporary comment. His insistence upon the importance of studying source literature based upon personal observation is an attitude equally commendable today. In another volume of his manuscripts this point is well brought out: seeking information on infectious diseases, he translated Linné's "Of the Cause of Intermittent Fevers, a New Hypothesis." Although he understood the original Latin, this undoubtedly had the object of basing his opinions on his own English translation to avoid controversy with those who might interpret the original Latin differently.

With the transposition of only a few terms his chapter on anatomy could be made a part of the most modern discussions on arrangement of curriculum and his conclusion to this chapter could be used without any change whatever in one of the great educational arguments of today.

His brief chapter, "Of Surgery," written at the precise time of the separation of the surgeons from the barbers, in its very brevity expresses the prevailing 18th century opinion of surgery which was still a handicraft and not a profession.

But each can draw information and details of personal interest from the different chapters of the "Introduction." From the standpoint of medical education Heberden has analyzed here the "required credits" of a candidate for the degree of Doctor of Medicine in the middle of the 18th century. As a Fellow at Cambridge for several years he gave courses in materia medica and so was thoroughly familiar with the method, or rather the lack of method, of instruction in vogue in medicine. He knew the deficiences at the University of Cambridge, from both the student's and the teacher's point of view, and was no doubt equally cognizant of conditions at Oxford. His individual attitude was such that it allowed him to acquire a superior education in spite of such deficiencies. In an autobiographical manner, following his usual custom of recording notes, he has here outlined a course in medicine ideal for the period. This document constitutes a very early if not the first systematic analysis of the needs of medical education and proposes a scheme which, had it been carried out, would have resulted in stabilizing medical education many years before this was actually done. His proposal made in Chapter 10 of this essay and subsequently elaborated and finally reprinted in his Appendix to the "Commentarii," which resulted in the publication of the Transactions of the Royal College of Physicians, in which he took such interest, produced a form of medical literature which by definite progress has become the standard of the best of our periodical press. It may be regretted greatly that his removal to London caused him to lose interest in questions of medical education, for, had he followed his usual method and elaborated the ideas expressed in this manuscript, medical education might have been advanced a full century.

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*P, Portrait.

A CHECK LIST OF HEBERDEN MANUSCRIPTS

In the Library of the Royal College of Physicians

"Collectanea spectantia ad historiam morborum et remediorum." (Commentarii)

Probably in the handwriting of Heberden. On the fly-leaf is written in pencil: "I desire this book may be given to Mrs. Heberden for the use of any of our sons who shall study Physic. W. H.," and underneath in the hand of the younger Heberden: "this & the english (sic) copy wch is in London have been collated, & agree with one another & with the other latin copy." This is apparently the original manuscript from which the "Commentarii de morborum historia et curatione" was published by Wm. Heberden, the Younger, in 1802. A few verbal alterations and some rearrangement of the chapters were made by the son, and the text is substantially the same as that of the printed book.

519 pp. sm. 4to. Bound in vellum. (1782?)

"Index historiae mornorum" (Adversaria)

On the fly-leaf the author has written in pencil: "I desire that this book may be given to any one of my sons who applies to the study of Physic. W.H." And underneath is the following note in the hand of Wm. Heberden, the younger. "The whole is in the handwriting of Dr. Heberden—containing the notes from which his Commentaries were drawn up. It is particularly requested that this book may on no account be taken out of the College, to whom it is presented by his son, W. Heberden." At the end of the manuscript the date, "22 Maii 1784." is written in pencil.

564 pp. sm. 4to. Bound in vellum. (1784?)

"Three Lectures containing some observations on the history, nature, and cure of poisons. Read at the College of Physicians on the 24th, 25th & 26th of August, 1749." The original manuscript of Heberden's Goulstonian Lectures, in his own handwriting. (Purchased from the Executors of Dr. Munk, Sept. 1899.)

100 leaves. Old calf. sm. 4to. 1749.

A copy of the above, from a manuscript in the Library of Queen's College, Cambridge, apparently in the handwriting of Thomas Harrison, Librarian of Queen's College, whose book-plate appears at the front of the volume. (Presented by Dr. Arnold Chaplin).

68 leaves. Half calf. Folio, 19th cent.

Another copy, in an 18th century hand. Inside the front cover are the inscriptions; "Rich'd. Wright, Surgeon, Nov. 10, 1811." and "Wm. Hammond, ex dono Gulielmi Salt, V. D. M. die Jovis, 21 Febrii, 1828." (Given or sold to the College by Mrs. Alfred

Jones, of Southbourne-on-Sea, at the instance of Sir Alfred Garrod.)
90 pp. Half calf. sm. 4to. 18th cent.

In the British Museum

"Dissertation on the Δαφτη, with a letter prefixed to Dr. Mead. 18th Dec. 1741.
Add. mss. #6269, f. 204."

"Letter and Observations on the Lauro-cerasus of the Romans, 1741."
Add. mss. #4436, 343.

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Add. mss. 26, 601, f. 285.

"Letter to Bishop Douglas. 1787."
Add. mss. 2185, f. 128.

"Letter to Lord Bute, 16th Jan. 1762."
Add. mss. 5720, f. 90.

"Letter to Dr. Heberden from Wm. Cole, with his answer respecting Mr. Baker. 1777."
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In the Library of St. John's College, Cambridge

"Three Lectures containing some observations of the History, Nature, and Cure of Poisons. Read at the College of Physicians on the 24th, 25th, & 26th of August, 1749, by W. Heberden, M.D., Fellow of St. John's College, Cambridge. Classmark, N-22."

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"Courses of Lectures on Materia Medica." (See Buller, *loc. cit.* p. 43).

In the Library of LeRoy Crummer M.D.

"An Introduction to the Study of Physic"*
"Preliminary Observations."

Written one side only. Chapter headings in most cases the same as in the published Commentaries.
4to. 74 ii.

"A Collection of Essays." Titles as given above.
4to. mss. 123 pp.

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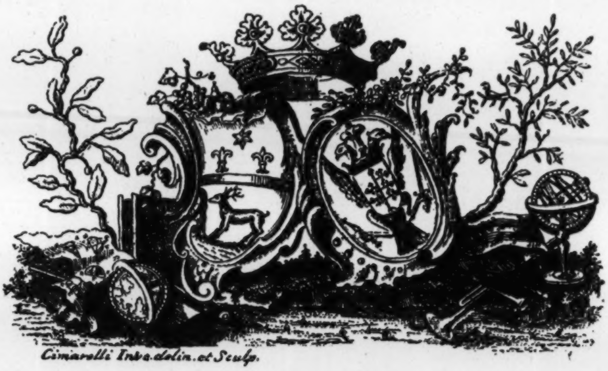
*Dr. Heberden's "An Introduction to the Study of Physic" for which Dr. Crummer has written the above Prefatory Essay will appear in the next issue of the ANNALS.


Cimarolli Inv.e delin. et Sculp.

[From Redi: Opere. Napoli, 1778.]

THE INFLUENCE OF JAMES BLUNDELL ON THE DEVELOPMENT OF BLOOD TRANSFUSION*

By HAROLD W. JONES, M.D. & GULDEN MACKMULL, M.D.

PHILADELPHIA

THE transfusion of blood fell into disrepute and practical oblivion after the decree of the French Chamber of Deputies in 1668.[1] This ban and the entailed punishment discouraged investigation on this subject and for almost a century and a half, only a few derogatory comments appear in text books and scarcely half a dozen cases are reported in the literature.

Hemorrhage and particularly that occurring post partum, appalled the obstetrician and surgeon. The treatment of this tragic complication was more a matter of despair than therapy. Death by a cause so obvious suggested the return of the blood into the circulation and James Blundell, a London obstetrician, encouraged by the experiments of Dr. Leacock of the Barbadoes[2] investigated the transfusion of blood "with a view of keeping this valuable operation before the profession and in the hope of adding somewhat to the body of facts."[2]

James Blundell was born in 1790. He was the nephew of the "Merciless Doctor" Haighton, the vivisectionist, physiologist, pupil of John Hunter, and Sir Astley Cooper's rival for lectureship in the Great Windmill Street school.[3] Beginning his studies in medicine under his uncle, he numbered among his preceptors Cooper, Cholmeley,[12] Munro, the Duncans and Hume. In his twenty-third year he received his medical degree from the University of Edinburgh, presenting, as his graduation thesis, a study of the differences in the senses of hearing and music "De sensu quo melos sensitur."[4] A year later he became active in obstetrical teaching with Dr. Haighton and upon the death of this uncle nine years later, succeeded to the chair of physiology and obstetrics at the combined schools of St. Thomas and Guy's Hospital. His lectures attracted the largest obstetrical classes in all London.[3] These lectures in Midwifery were published in the Lancet during the legal controversy between its editor and Sir Astley Cooper. The sharp censure which Blundell received for so endorsing an adversary of Guy's Hospital, caused a breach in his relations with the institution he had served for twenty-four years. These lectures were subsequently published in book form in Washington, D. C. and his "Obstetrics" was probably one of the few medical books, printed here at that time.[5]

In 1819 Blundell elucidated some controversial points on the generation in mammals[2]; in 1821 he conducted a series of careful experiments on rabbits and concluded:

> From these experiments the author is inclined to infer presumptively that moderate opening into the human peritoneum will not necessarily nor more generally prove fatal from inflammation or otherwise, and further that certain viscera or parts of viscera not essential to the welfare of our structure may be removed from the belly without necessarily or even generally producing death.[2]

In these investigations he removed the kidney, spleen and pieces of the urinary bladder, and encouraged by these results he advocated bolder abdominal surgery. The Lancet in critically reviewing this book conceded the possibility and necessity of opening the abdominal cavity and perhaps removing an ovary but asks "What benefit can we ever expect from removing the spleen?"[6] Blundell removed a cancerous uterus vaginally in a Mrs. Moulden which was possibly the first operation of its kind in Great Britain (Ref. 2, fly leaf). A year later the autopsy of this patient was done by Thomas Hodgkin and the specimen is now in the Museum of the Royal College of Physicians of London.[7]

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* From the Medical Department of Jefferson Medical College Hospital. Read before the section of Medical History, College of Physicians, Phila. October 27, 1927.

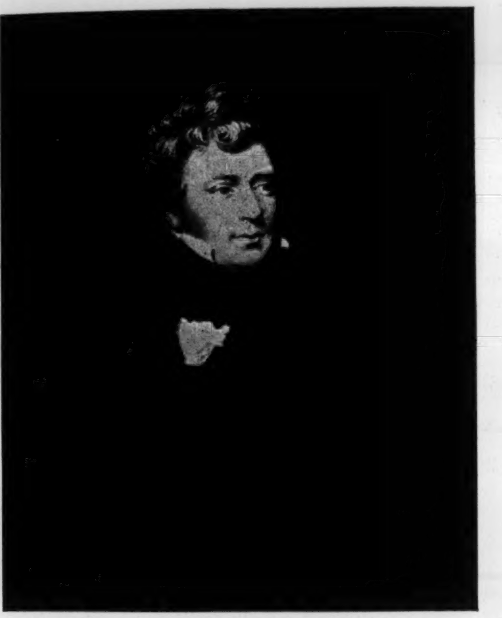

FIG. 1. JAMES BLUNDELL (1790–1877).

It was during this period of his life that Blundell became interested in the neglected operation of the transfusion of blood, a subject with which his name will probably be connected as long as this procedure is practiced.

The breach between Blundell and his contemporaries at Guy's Hospital widened and in 1838, while on a visit to the continent, a successor was appointed without consulting him. This break in precedent deprived Blundell of the usual emolument received in the transfer of a Chair; he became incensed, severed all relations with the hospital, removed the remainder of his museum and library and drove away in his 'Yellowish Chariot" never to return.[8]

Soon afterward he retired from active practice probably influenced by a fortune of 550,000 pounds sterling which he had accumulated in practice and in bequests.[9] The remainder of his leisurely bachelorhood was devoted to the classics and in collecting a library which at the time of his death in 1877 numbered over three hundred rare volumes on Midwifery and Diseases Peculiar to Women.[10]

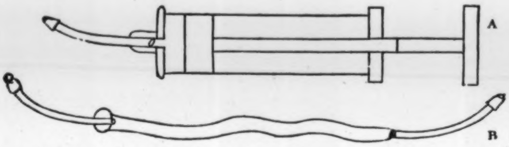

FIG. 2. A. THE SIMPLE SYRINGE USED IN SUCKING BLOOD FROM A TUMBLER PRIOR TO INJECTION INTO A VEIN. B. THE TUBE FOR THE DIRECT TRANSFUSION FROM ARTERY TO VEIN.

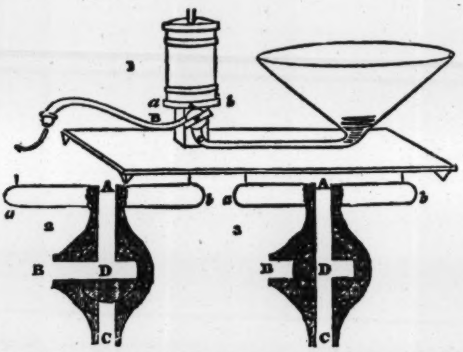

FIG 3. THE EARLIEST MODIFICATION OF THE SYRINGE. THE BLOOD WAS DIRECTED INTO A CUP, THE PISTON OF THE SYRINGE PULLED UPWARD AND THE BLOOD FORCED INTO THE BARREL OF THE SYRINGE. THE STOP-COCK (SHOWN IN CROSS SECTION) IS TURNED AND THE BLOOD FORCED INTO THE VEIN OF THE PATIENT. NOTE THE SIMILARITY TO THE UNGER APPARATUS, PARTICULARLY THE STOP-COCK.

When Blundell devoted his attention to the neglected operation of blood transfusion he found practically a virgin field with little but guesswork and disastrous results prejudicing the minds of the physicians against this procedure. Most of the previous thought on the transfusion question was dominated by the pre-Harveian physiology of the blood. Ideas were still prevalent that the blood was "alive." John Hunter wrote in 1817, "One of the great proofs that the blood possesses life depends upon the circumstances affecting its coagulation. If the blood had not the living principle it would be in respect to the body as an extraneous substance."[11] "The inclinations follow ordinarily the constitution of our blood and the inequalities which one meets with in the minds of men are owing to the diversity of their blood" writes Lamy quoted by a confrere of Blundell.[13] Reflecting on these prevalent notions and believing that the technical details of the operation of transfusion were responsible for the failures, Blundell decided "As it seemed doubtful whether the blood would remain fit for the animal functions after the passage through the instrument, the following experiments were constructed with a view to ascertain the point submitted to recommend a rejected operation to the experimental investigation it seemed to deserve."[14]

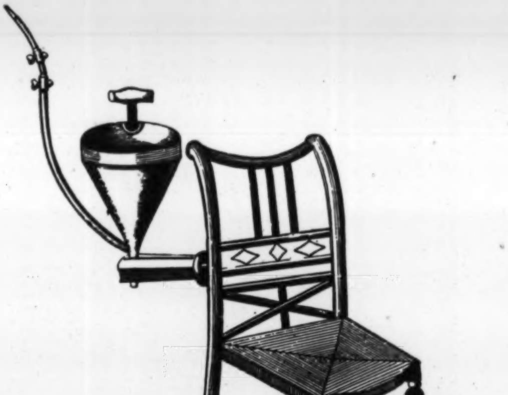

FIG. 4. THE "IMPELLOR" ADJUSTED TO THE CHAIR READY FOR TRANSFUSION.

The investigations were performed upon dogs and constitute one of the first systematic and extensive experiments upon transfusion of blood. The methods were, first, the direct connection between artery and vein by the use of the time-honored cannula (Fig. 2B); then a plain syringe (Fig. 2A) in which the blood was first run into a tumbler and then sucked up into the barrel of the instrument and thus injected into the vein of the recipient; and finally the modifications of the syringe which will be described in their places. Having become satisfied that the blood would not be vitiated by the simple manipulation of putting it into a container, Blundell constructed an apparatus which he believed would facilitate transfusion; the principle of which is reflected in many of our modern appliances (Fig. 3).

> The whole apparatus is mounted perpendicularly on an upright post and the floor on which this rests is poised with lead in order that the operator may not be embarrassed by the instability of the instrument. The joints are air tight. The syringe . . . is made of brass. Its capacity is eleven drams; small in order that the blood may not be thrown into the vessels too rapidly nor retained too long, and of a determinate size in order that the operator may measure the quantity of blood which he injects. The tube which discharges should be made of very pliant leather and that which admits the blood may be of the flexible metal used for catheters[14] [Fig. 3].

These experiments established that the blood lost none of its life-giving properties by passage through a syringe; that arterial blood was equally beneficial despite the artery of source; that venous blood may be successfully used though perhaps arterial is preferable; that air injected into the veins even to twenty cubic centimeters is not lethal; that an animal may be saved from death by hemorrhage by the transfusion of a much smaller quantity than that which is lost; that blood should not be injected too rapidly and that the blood of one genus of animal cannot be indifferently substituted in large quantities with impunity and, therefore, if the operation be performed upon the human body human blood should be employed until 'some other blood be found which is equally congenial to the vessels.'[2]

Blundell reported in the Medical-Chirurgical Transactions of 1818 his first attempt of transfusion in man. This patient suffered obstinate vomiting and weakness caused by "scirrhosity of the pylorus" as demonstrated at autopsy. Following the injection of 12 ounces of blood by the syringe (probably the one in Fig. 3), the man felt better, but died after fifty-six hours. Blundell was not discouraged and states: "The case gives additional strength to the opinion that human blood although transmitted through the syringe may still retain a positive fitness for animal purposes."[15]

He had an idea that "Death from bleeding (like that of hanging or submersion) may also for a time be apparent . . . it is not impossible that transfusion may be of service within a given time even after breathing has stopped." He attempted to prove this in Case Number 2, and a young woman dead for five or six minutes of "Placental hemorrhage" was transfused by the syringe with 16 ounces of blood without recovery.[2]

Case Number 3, a woman with very severe hemorrhage during childbirth was transfused with 4 oz. of blood by the syringe before respiration ceased but "being unable to secure more blood, she expired."[2]

Case Number 4, a woman ill with puerperal fever was transfused by the syringe with 6 ounces of blood. "No decisive effect of any kind was produced by the operation and the lady died of fever without suffering any extraordinary symptoms."[2]

Case Number 5, Dr. Doubleday assisted Blundell in injecting, with 14 ounces of blood, a woman dying of uterine hemorrhage. She is reported to have said after 6 ounces had been transfused "I feel as strong as a bull." She recovered.[16]

Case Number 6, a patient of Dr. Waller who, bleeding post partum, was transfused by the syringe with 4 ounces of blood and recovered.[17] This result was questioned. It was maintained that the quantity of blood was insufficient to restore a patient, but Blundell argued that as no other therapy had been effective the prompt result must have been due to the transfusion.[18]

The influence of Blundell as an investigator and teacher caused this new operation to be taken up by the profession; particularly the obstetricians. Mr. Waller, the London midwife, offered as the obstetrical prize to his students "A handsome set of transfusion instruments contained in a mahogany case bearing a suitable inscription."[19]

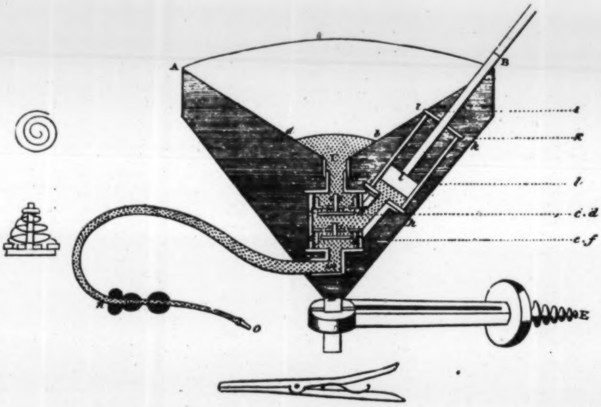

FIG. 5. A CROSS SECTION OF THE "IMPELLOR" OUTLINING THE INTRICATE AND DELICATE VALVES. THE OPJECTION RAISED TO THIS INSTRUMENT WAS THE EASE WITH WHICH THE BLOOD CONGEALED.

With a view to perfecting his procedure Blundell introduced a new instrument (Fig. 4) in 1824:

> When in consequence of the want of arterial blood it becomes necessary to transfuse the venous, a different method of operating must be adopted and in the present state of our knowledge I would recommend in such cases the employment of the Impellor.

This singular instrument was attached to a chair by a screw. The inner cup was filled with water, "milk warm" (96°) in such a manner as to exclude air. A vein was then laid bare on the forearm of the patient, incised and the tubule introduced. No ligatures were used, the tubule being held in place by the assistant. The donor seated himself in the chair; the arm was opened by a lancet as in venesection and the blood directed into the cup. By "long strokes with short and sharp movements" the blood is impelled into the vein of the recipient. (Figs. 4, 5.)[2,5]

Case Number 7, a young man dead for three or four minutes of hemorrhage from "bursting of an artery" was transfused by the "Impellor" with 16 ounces of human blood without resurrection.[2]

Case Number 8, a woman with hemorrhage following the delivery of the placenta was successfully transfused with 12 ounces of blood and recovered. The "Impellor" was used in this operation and Dr. Blundell applied 12 leeches to the arm in anticipation of inflammation which did not occur.[6]

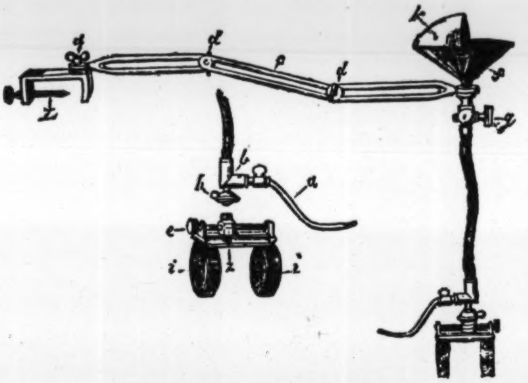

Fig. 6. The Gravitator.

During this period a number of unsuccessful cases of transfusion were reported by various surgeons. It appeared that blood transfusion was again to go into discard. Fearing that the report of these untoward results would give an erroneous impression he suggested at the meeting of the Medical Society that no more adverse cases be published until "a complete body of evidence upon the subject be obtained." This proposition was rejected as an attempt to hide the true status of the operation.[20]

These various instruments had obvious disadvantages. The reactions from transfusion were often quite serious and not knowing the chemistry of hemagglutination these effects were often attributed to the instrument. Although Blundell apparently abandoned the syringe methods he remarks:

> I may be permitted to state my own persuasion to be that transfusion by the syringe is a very feasible and useful operation and that after undergoing the usual ordeal of neglect, opposition and ridicule it may hereafter be admitted to general practice.[2]

Braxton Hicks after attempting to transfuse with Blundell's funnel and syringe (probably meaning the "Impellor") remarks:

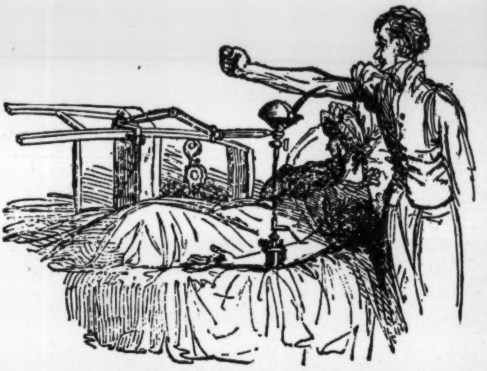

Fig. 7. Method of Using the Gravitator.

> The coagulation of blood was the greatest trouble which interfered with the performance of the operation. The instrument had to be washed out two or three times owing to coagulation during the check in the supply from fainting of the blood-giver, but I believe no clot was injected into the vein.[21]

In 1828 a fourth method was devised and introduced with this comment:

> In the present state of our knowledge respecting the operation although it has not been clearly shown to have proved fatal in any one instance, yet not to mention possible though unknown risks, inflammation of an arm has certainly been produced by it on one or two occasions and therefore, it seems right as the operation now stands to confine transfusions to the first class of cases only, namely, those in which there seems to be no hope unless blood can be thrown into the veins. The object of the gravitator [Figs. 6, 7] is to help in this last extremity.[22]

Case Number 9, the life of a boy dying from secondary hemorrhage following amputation of the leg, was saved by the gravitator.[7]

Case Number 10, a successful transfusion after 8 ounces of blood were injected during a period of three hours in a patient with uterine hemorrhage.[23]

Our search of the literature reveals that James Blundell performed the operation of blood transfusion 10 times. His biographers, Wilks and Bettany[8] record 11 but they include the case of hydrophobia which was transfused with water (Magendie operation). Landois[24] records 9 for Blundell and 9 for Drinkard.[5] Of the 10 authentic cases detailed above 5 were successful and 5 failed. When we recount that 2 of these patients were already dead and a third dying of cancer, we find 5 of the 8 cases successful.

The influence of Blundell is acknowledged by all those who have investigated the development of the therapeutic measure under discussion. Von Ziemssen[25] states that Blundell did the first real transfusion after Denys. Roussell,[26] a contemporary of Blundell writes, "Since the labours of Blundell, transfusion has never been lost sight of in England or other countries." In the United States when the demand for the introduction of an apparatus for blood transfusion was felt the New Orleans Medical and Surgical Society lauded the work of Blundell and favored the importation of his instrument (the syringe).

The statement of a recent authority,[28] that James Blundell neither advanced the knowledge nor improved the technic of blood transfusion, is to ignore the fact that he was one of the first to scientifically investigate this subject; that he devised instruments which find their modern expression in the syringe and its modifications, the cylinder and modified blood methods; that he was one of the first to establish the principle that only blood of the same species should be used; that blood lost none of its life-giving properties by passing through an instrument; that blood from any artery was satisfactory; that venous blood was as satisfactory as arterial; that blood should not be injected too quickly; that air should be excluded from the apparatus; that the injection of air up to 20 c.c. was not necessarily fatal; that he was the first to develop adequate means for measuring the amount of blood; that it was not only unnecessary but undesirable to transfuse the same amount of blood as had been lost; that he took up this work after a period of nearly one hundred and fifty years of disuse and that he performed more successful transfusions on humans than any other man before his time. Therefore, we feel his work warrants a place for him with such men as Denys, Hayem, Landsteiner, Jansky, Crile, Lindeman, Lewisohn and Unger as being influential in the development of the art of blood transfusions as we know it today.

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DR. JOHN RUTTY OF DUBLIN

AND HIS "SPIRITUAL DIARY AND SOLILOQUIES"

By WILLIAM T. S. SHARPLESS, M.D.

WEST CHESTER, PA.

IN the Friends' Quarterly Examiner of London for January 1925 there is a very entertaining short sketch by Arthur I. Ashton of Dr. John Rutty of Dublin. This periodical is devoted largely to principles, practices and history of the Society of Friends. Dr. Rutty was a member of and a strict adherent to the principles of this sect. This article stimulated an interest in this curious and interesting character and a desire to know more of him. After running out various clues it was found that Dr. Rayner W. Kelsey of Haverford College has nearly all of the available information about Dr. Rutty and it is from Dr. Kelsey that most of the matter presented in this paper has been secured.

Dr. Rutty was a mystic and a quietist and throughout his long life he preached and practiced the subordination of all earthly and human affairs to those spiritual influences which he believed to be the infallible guide of his life and which he regarded as emanating from the source of truth itself. His interest in natural science and especially in the sciences related to medicine was very great, and his contribution to these sciences was not inconsiderable. We shall see how earnestly he strove to keep his interest in these proper studies within their proper place, and not to allow them to appropriate any part of the time and attention that should be bestowed on what he considered the vastly more important interests of the spiritual life. The Quaker sect came into existence during the time of the Stuarts and of the Commonwealth. It was an expression of the great religious unrest of that time, and of the revolt from ecclesiastical authority and dogma. Persecution which they endured in their earliest history had spent its force before the time of Dr. Rutty, and like most of the mystics in the eighteenth century they had settled into a quietism that encouraged deep introspection that too often became morbid, and a self-denial that sometimes approached asceticism. Possibly as part of this conception of his duty, he has left us very meagre accounts of his ancestry and early life. Indeed throughout his writings there is a lamentable lack of the sort of information that appeals to the student of medical history. For instance, he graduated in medicine at the University of Leyden in 1725 or possibly 1723 at which time Boerhaave, the greatest physician and medical teacher of his time, occupied the chair of chemistry and medicine in that University and yet so far as noted, in his writings, there is no reference whatever to this fact.

Perhaps Boerhaave did not appear to his pupils so great a man as he seems to us, seen through the perspective of two hundred years.

Before taking up his "Spiritual Diary and Soliloquies" we should mention the references to Dr. Rutty both by those who knew him and those who have studied his life and work.

In the "Dictionary of National Biography" there is an article which it is worth while quoting in full:

> Rutty, John, M.D. (1698–1775), physician, was born in Wiltshire, of Quaker parents on 25 Dec. 1698, and after medical education at Leyden, where he graduated M.D. in 1723, settled in Dublin as a physician in 1724, and there practiced throughout his life. He had been brought up a member of the Society of Friends, and was zealously attached to its tenets and discipline. He was a constant student of medicine and the allied sciences, as well as of spiritual

books, such as those of Thomas a Kempis, Law, the Port Royalists, and Watts. He lived sparely, sometimes dined on nettles, practiced various forms of abstinence, drank very little alcohol, and often gave his services to the poor. In 1737 he began, he says, to form a just conception of the nature of this life, and saw it as a scene of sorrows, infirmities, and sins. In 1753 he began on 13 Sept. to keep "a spiritual diary and soliloquies," and continued it till December 1774, leaving directions in his will for its publication. The chief ill-doings of which he accuses himself are too great a love for the studies of the materia medica and meteorology, irritability, and excessive enjoyment of food. Though he deplores these excesses in language which seems disproportioned, and which justly excited Dr. Johnson's laugh [Boswell's Johnson, II.155], it is clear that he was sincere and that his life was blameless. He avoided every kind of excess except that of verbal expression, as when he speaks, in 1768, of the "dismal wounding news from England, even the vain profusion of expense in diamonds on occasion of the visit of the King of Denmark." His first medical book was "an Account of Experiments on Joanna Stephen's Medicine for the Stone," published in Dublin. In 1751 he published "A History of the Rise and Progress of the People called Quakers in Ireland, from 1653 to 1751," which was "a continuation of a book originally written by Thomas Wight of Cork in 1700"; a fourth edition was issued in 1811. In 1757 he published in London "A Methodical Synopsis of Mineral Waters," a quarto of 658 pages, which gives an account of the chief mineral springs of the British Isles and of Europe. He had thrown doubt on some statements of Charles Lucas [1713–1771] /q.v./ in his account of the spa of Lisdoonvarna, cc. Clare, and Lucas issued a general attack on the book, of which Rutty remarks in his diary, "a wholesome discipline, though severe." He published in Dublin, in 1762, a tract called "The Analysis of Milk," and in 1770 "The Weather and Seasons in Dublin for Forty Years," which mentions the prevalent diseases throughout the period. He was always fond of natural history, and in 1772 published "A Natural History of the County of Dublin" in two volumes. His last work was published in quarto at Rotterdam in 1775. It was a Latin treatise on drugs, containing much learning, entitled "Materia Medica Antiqua et Nova," and is still useful for reference. It had occupied him for forty years. On 6 April 1775 John Wesley [*Journal*, IV.40] records that he "visited that venerable man Dr. Rutty." [Rutty then lived in rooms, for which he paid an annual rent of 10 L., at the eastern corner of Boot Lane and Mary's Lane in Dublin.] He died on 27 April 1775, and was buried in a Quaker burial-ground which occupied the site of the present College of Surgeons in Stephen's Green, Dublin.

The reference to Dr. Johnson's laugh at Dr. Rutty's diary is reported in Boswell's life and is said to have been with one exception the only occasion on which Dr. Johnson indulged in uproarious hilarity. The other occasion was when the Doctor was told by a friend that a mutual acquaintance had made a will. The idea of this man making a will seemed so absurd and preposterous to the Doctor that he went home through the night making the streets of London echo with his resounding laughter.

The passage in Boswell is as follows: "He [Johnson] was much diverted with an article which I showed him in the *Critical Review* of this year [1777], giving an account of a curious publication, entitled, 'A Spiritual Diary and Soliloquies by John Rutty, M.D.' Dr. Rutty was one of the people called Quakers, a physician of some eminence in Dublin, and author of several works. This 'Diary,' which was kept from 1753 to 1775, the year in which he died, and was now published in two volumes octavo, exhibited in the simplicity of his heart, a minute and honest register of the state of his mind; which, though frequently laughable enough, was not more so than the history of many men would be, if recorded with equal fairness.

"The following specimens were extracted by the reviewers:

Tenth month 23, 1753 Indulgence in bed an hour too long.

Twelfth month 17, An hypochondriack obnubilation from wind and indigestion.

Ninth month 28, An over-dose of whisky.

Ninth month 29, A dull, cross cholerick day.

First month 22, 1757 A little swinish at dinner and repast.

First month 31, 1757 Dogged on provocation.

Second month 5, 1757 Very dogged or snappish.

Second month 14, 1757 Snappish on fasting.

Second month 26, 1757 Cursed snappishness to those under me, on a bodily indisposition.

Third month 11, 1757 On a provocation, exercised a dumb resentment for two days, instead of scolding.

Third month 22, 1757 Scolding too vehemently.

Third month 23, 1757 Dogged again.

Fourth month 29, 1757 Mechanically and sinfully dogged.

"Johnson laughed heartily at this good Quietist's self-condemning minutes; particularly at his mentioning, with such a serious regret, occasional instances of 'Swinishness in eating, and doggedness of temper.'"

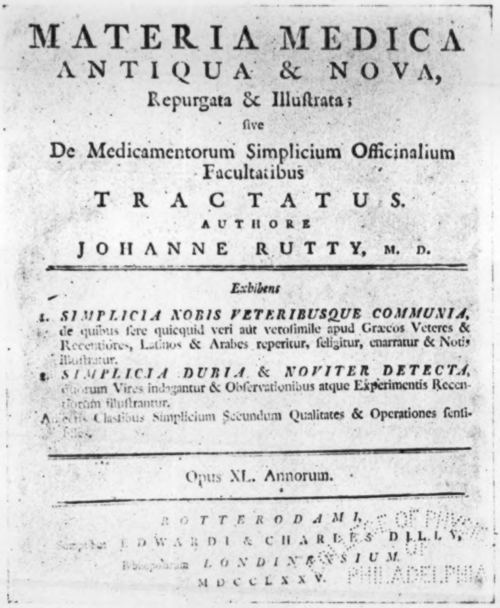
The reference to Dr. Rutty in *John Wesley's Journal* is as follows:

1748 Mon. 25th of April. Finding my fever greatly increased, I judged it would be best to keep my bed, and to live a while on apples and apple-tea. On Tuesday I was quite well, and should have preached, but that Dr. Rutty [who had been with me twice] insisted on my resting for a time.

1749 Mon. 24th of April. The cold which I had had for some days growing worse and worse, and the swelling which began in my cheek increasing greatly, and paining me much, I sent for Dr. Rutty. But, in the meantime, I applied boiled nettles, which took away the pain in a moment. Afterwards I used warm treacle, which so abated the swelling that before the doctor came I was almost well. However, he advised me not to go out that day. But I had appointed to read the letters in the evening. I returned home as early as I could, and found no inconvenience.

And on 1775 Thur. 6th of April I visited that venerable man, Dr. Rutty, just tottering over the grave; but still clear in his understanding, full of faith and love, and patiently waiting till his change should come.

A footnote says in Wesley's Journal "The famous physician died three weeks after Wesley's visit. He was held in high repute not only for his professional skill, but as a writer, a naturalist, a highly spiritual member of the Society of Friends."



MATERIA MEDICA
ANTIQUA & NOVA,
Repurgata & Illuſtrata;
ſive
De Medicamentorum Simplicium Officinalium
Facultatibus
TRACTATUS.
AUTHORE
JOHANNE RUTTY, M. D.

Exhibens

1. SIMPLICIA NOBIS VETERIBUSQUE COMMUNIA, de quibus ſere quicquid veri aut veroſimile apud Græcos Veteres & Recentiores, Latinos & Arabes reperitur, ſeligitur, enarratur & Notis illuſtratur.
2. SIMPLICIA DUBIA & NOVITER DETECTA, Quorum Vires indagantur & Obſervationibus atque Experimentis Recentiorum illuſtrantur.

Adjectis Claſſibus Simplicium Secundum Qualitates & Operationes ſenſibiles.

Opus XL. Annorum.

ROTTERODAMI,
Sumptibus EDWARDI & CHARLES DILLY,
Bibliopolarum LONDINENSIUM.
MDCCLXXV.

OF PHYS OF PHILADELPHIA

TITLE PAGE OF THE MATERIA MEDICA OF DR. JOHN RUTTY.

In Rutty's Diary under date of 4.14.1762, there is this entry;

An interview with John Wesley with an agreeable account of the destruction of bigotry and the prevalence of universal charity in Scotland, and of the permanence and increase of the heavenly fire kindled among the Colliers in 1737 and the next among the miners. A particular account of the conversion of two hardened criminals in Newgate.

The "Materia Medica" which Dr. Rutty rather pathetically refers to on the title page as "Opus XL Annorum" was published in Latin in 1775. His classification of remedies is not based so much on the effects of the drugs as upon their age and their recognition by the ancients as compared with the drugs in more recent use, although he says "Adjectis Classibus Simplicium Secundum Qualitatis et Operationes Sensibles" "Associated Classes of the Simples showing their Sensible Qualities and Effects" [classes of the simples placed together showing their sensible qualities and effects].

Medicine, in his time, was a much more stationary science than in ours. Most drugs in use forty years ago are now discarded or relegated to a less important place, but one hundred and fifty or two hundred years ago the administration of drugs was largely governed by empiricism and tradition and some of the formulae of medieval physicians were still accepted. His "Materia Medica" is now rarely referred to and the faithful work of forty years is lost in the modern scientific study of therapeutics.

His work on the medicinal effects of the waters of the chief mineral springs of the British Isles and of Europe has shared the same fate as the "Materia Medica." It is only rescued from complete oblivion by some echoes of the controversy it occasioned with Dr. Charles Lucas who has been called the Wilkes of Ireland. If we recall the stormy career of the English Wilkes we may appreciate in some measure the sort of a man the quiet Quaker had to encounter, for of him Macaulay says, "He was clever, courageous, unscrupulous, expert in resource, humorous and witty, could abate and dissolve a pompous gentleman with singular felicity." No doubt Lucas considered Rutty as belonging to the class referred to by Macaulay: for he says that Rutty's book was "a most pompous massive volume obtruded upon the public," and its 700 pages probably gave the Irish Wilkes an opportunity for the exercise of those qualities of invective which Macaulay said belonged to his English prototype. Lucas is said to have had an old grudge against Rutty based on a difference of opinion as to the medicinal properties of the waters of a spring that rejoices in the beautiful Irish name of Lisdoonvarna. Rutty's friends came to his assistance and a pamphlet war was the result, which, as quoted above, Rutty said was a "Wholesome discipline but severe."

In the article above referred to in the *Friends' Quarterly Examiner*, the author evidently had access to some of Dr. Rutty's works that I have not seen. The following interesting quotation concerning the "Natural History of the Dublin District" is from that article:

> The National History of the Dublin District throws some light on the habits of the Dubliners in the eighteenth century. The Doctor is struck by the lavish consumption of fish and flesh but thinks that the resulting fevers are counteracted by the liberal use of buttermilk, potatoes, and oatmeal. Cider was then manufactured locally, but the "sole liquor" he says, with which all above the lower class regale themselves, is French claret of which in 1753 about eight thousand tons were imported. He laments the increasing use of whiskey which "corrupts the morals, destroys the constitution of both sexes, and debases and enfeebles their progeny." Within the "city and liberties" of Dublin there were, he tells us, 3,500 houses in which drink was sold. In the section devoted to plants he notes that heather "supplies us with little beesoms and is used in the thatching of cabbins," and he recommends the practice of the Scottish mountaineers, who make beds of it, which "in some measure vie with feather-beds." "Nettles," we learn, "are useful not only for the making of broth but as a means of turning the green gooseberry red."

Medical theories concerning the use of drugs and mineral water change with the times and with advancing knowledge but human emotions and human aspirations remain unchanged throughout the ages, and it is with these that Dr. Rutty deals in the only one of his works that has anything but a historical interest for the present generation. This is his "Spiritual Diary and Soliloquies" provision for the publication of which was made in his will. It is largely self-accusatory and recounts his frailties and failures, his slothfulness, his excesses in eating and drinking, his occasional outbreaks of temper, and especially his lack of resolution in permitting his interest in proper worldly affairs to draw him away from those spiritual concerns that are the chief interests of his life. If he was guilty of any gross iniquities he does not mention them and he almost certainly would if we may judge from his attitude toward those peccadilloes which most of us would consider scarcely worthy of remark. The general character of his life was certainly pure and upright and to this fact there is abundant testimony by those who knew him. In a footnote to the introduction to the "Diary" there is a memorial signed by fifty of his friends and acquaintances which is as follows:

> We have been many years acquainted with the late Doctor John Rutty, and being informed that it would be acceptable to some of his friends, to have the general character he bore among us prefixed to a publication, intended in London, of a treatise wrote by him, entitled, "A Spiritual Diary," do [in compliance therewith] send it, being briefly as follows:
>
> "He was esteemed a skilful and successful physician, and was well beloved in this city, being an exemplary and useful member both of civil and religious society. His temper appeared pleasing, and well guarded; mild in reasoning with persons from whom he differed in judgment, even on important and interesting subjects. He was accounted temperate in eating and drinking. He generally used to rise early in the morning to his studies. He wrote and published sundry tracts, to extend medical knowledge, botany, and natural history, some of them pretty voluminous; beside several on religious subjects, to excite to piety and virtue.
>
> "He was plain in dress and address. He declined ostentation, and adopted a lowly way of living. He was charitable to the poor, many of whom almost daily resorted to him for his advice and help; others, prevented by their distempers, he visited at their dwellings, and exercised a tender care toward them.
>
> "He was earnestly concerned for the youth; often advising them, early to make a right choice, that [being guided by divine wisdom] they might become ornaments of the society.
>
> "The remembrance of his useful services has endeared his memory to us, and to many more. In a good old age he departed this life, with thanksgiving to God." Signed by about fifty of his acquaintances.
>
> Dublin, 29th of the 2d Month, 1776.

Perhaps this is the only instance or record in which a man's friends felt obliged publicly to defend his memory on account of accusations against his own character and life made by himself.

As suggested by the title, most of the entries in the "Diary" refer to conduct or to his religious life. There are very few that give any information concerning his scientific work or the practice of medicine though on 10.3.1771 he says, "At our medical convention some real profit but with a mixture of ungodly jokes. I fear I countenanced them too much." From which it appears medical conventions in the eighteenth century were not very different from those of the twentieth. In his "Diary" no lapse from absolute propriety of conduct is too slight to escape his condemning acknowledgment of it and is usually followed by his resolution to reform. From a great many such entries we select the following:

9 .18.1753	Two sudden transports of passion.
.26.	Mechanically morose.
11.21.1753	Lay late and belated at meeting to my own and others' bad example. Doubted my regeneration from remains of fierceness unsubdued.
.23.	Notwithstanding the repullulances of my ugly fierceness. God favored me with some precious illuminations.
12.12.	Guilty of laying my hands on one too suddenly.
1 .11.1754	At a parliament meeting, feasted, sat up shamefully, yea wickedly, long, to the encouragement of luxury in drinking and to the weakening of the holy testimony, and in reality denying the Lord before men. I repented a little and do and will repent and I hope amend. It was a bewitching time with much stupidity and inadvertence.

.18. An humbling time on a second review of the above. Let it be marked *nigro carbone* [with a black coal.]

.20. The late deviation to superfluous drinking was not owing to the lust of the flesh but to the love of the world.

.26. A transport of anger in which I struck my servant.

2 .11. Weak and fretful. Licked spittle in two places. Insolent in two others.

3 .1 .1754 Anger previous to meeting, a bad preparation for it. Overseer, oversee thyself.

3 .2 . The occasion of yesterdays transport of anger appears to be in great measure a mistake. Feasted a little beyond the holy bounds and was most righteously chastised by a subsequent sickness.

3 .15. The pipe enslaves.

3 .18. Feasted beyond the holy bounds with two dear bewitching friends. [We would like to know more of this.]

4 .13. Snappish.

5 .3 . Sin in smoking for mere pleasure, not health.

9 .20. Morose, spoke very rashly and unrighteously and my anger was applied to the wrong object. Lord have mercy upon me a sinner.

9 .22. Very brittle on a small occasion.

9 .23. Brittle again.

10.18. O that I may not abuse riches. Certain it is I often have in guzzling.

11.1. Choler reigned and impelled into indecencies, not to say sins. Lord pity and correct Principiis Obsta [withstand the first motions] is a good maxim.

11.3 . Licked spittle a little.

.24. Feasted, not innocently in not refusing the bumper.

2 .18.1755 Cicero the heathen is above me in the government of passion.

.24. Ate too much, was too cross.

7 .16. Dogged, ate too much.

.23. Told a lie in haste.

9 .24. Snappish on a call to a child, which, however, I answered. [Please note that though snappish, *he answered*.]

9 .28.1755 An overdose of whiskey.

12.6 . Learn to repine less at small trifles and flea bites thou pitiful jack-straw. The refusal of a fee from a poor patient gave more pleasure than receiving one from the rich.

12.10. Some remains of doggishness on a call to a pauper.

.27. Vicious complaisance though in one solitary glass only O, for the "lenior et melior sis accedente senecta" [Dost thou become wiser and better with advancing age] of Horace. [He quotes Horace more frequently than any other Latin author though he seems to have been familiar with many.]

.31. Two glorious patients in Canaan's language, vis; paupers, Lord raise many of these to think and act! So may physick be an introduction to glory.

4 .16.1756 A little incubus last night on too much spinage.

5 .8 . An advertence in drinking gave the headache and great dulness in the afternoon meeting.

.19. A little of the beast in drinking.

6 .3 . A feast very dissatisfactory from without and inadvertence and swinishness from within.

6 .17. Feasted a little piggishly.

2 .16.1757 Beware of blasphemy with regard to the weather. [A caution most of us need.]

1 .1 .1758 A slight headache on the compotations and watching with entertainment.

8 .1 . A little piggish in stuffing with vegetables.

1 .10.1759 Feasted swinishly and to inflation.

.25. A luxurious dinner on apple pie.

2 .25. Feasted to the utmost bounds, though with a saint.

1 .21.1760 Snapped at a pauper in the street.

11.5 .1766 Ate as a swine today, even on the great day of the general assembly of the ministers and elders but resolve with Thy help never more to repeat this sin *on this occasion.*

6 .17.1768 A Botanic journey on principle with a feast but this last had something of a sting in the tail.

5 .17.1769 A certain feast left a sting in the tail for want of the holy fear in the cup.

[This gives an idea of the sort of self-accusation that fills the pages of his diary. He seems often to have been annoyed by what he calls "unreasonable calls."]

11.10.1753 Some remains of old Adam in a scornful look on an innocent call to a patient.

6 .14.1755 Vexed sorely and inordinately by a call on a hot day.

12.12. Some remains of doggishness on a call to a pauper.

1 .3 .1756 Lord give me the true spirit of charity in my exercise among the poor.

1 .5 .1756 Bad usage from a patient utterly unworthy of attendance. I resented it enough. "Lenior et melior sis accedente Senecta." [Dost thou become wiser and better with advancing age.]

3 .2 . Seven patients mostly paupers. Lord give relish to the entertainment.

3 .16. Two patients to whom more of giving than of receiving.

4 .1 . Ebbing times as to cash.

6 .5 . An affront on the street. An unknown man pinched me. I resented it with calmness and resolution.

6 .24. Choleric merely on an unreasonable call from a poor man. Who is vile and I am not more vile.

8 .5 . Lost a fee pretty contentedly on this occasion.

9 .14. Not a single penny for nearly some weeks. Lord grant a relish for friendship and charity. [This notwithstanding that on 8.8 of the same year he had written the the "Lord is trying with riches," and 8.16, "O what a trial is prosperity."]

9 .30.1756 Patience exercised on the unrighteous withholding of fees by one patient and impudence by another. A good trial for a christian.

11.1 My servant says I am actually more cross notwithstanding my late higher pretension. Indeed I do not altogether believe her.

11.18. Eleven patients and twelve visits.

11.29. An accuser of the brethren called me a liar in public which I answered not.

12.16.1758 The paupers are considerably more numerous than the solvents. Blessed be the Lord.

8 .10.1764 Take care, Take care of the fumes of cider and whiskey. Tremble at the mixture.

[This reminds one of Benjamin Rush's caution concerning as he says "What is called 'Cherry Bounce.'"]

3 .18.1758 Seven patients even without a penny, even as usual.

.22. Murmured at the call of a pauper, but went.

.28. Seven patients mostly paupers, Lord support.

10.26. Two visits and one fee.

.28. Eleven visits and no fee.

8 .30.1760 Eight patients and not a penny, so much the more glorious.

6 .19.1763 Hard struggle between meeting and patients, though mostly paupers. Blessed be the Lord in whose eyes the serving of them is more glorious than the splendors of Babylon.

8 .26. Attended nine patients, six of which are the glorious poor.

12.28.1765 Sweet content and thankfulness even on the withholding of fees; a junior picking up my crumbs, an event affording a happy leisure for the great work of the Materia Medica.

9 .27.1766 God, open my eyes to see a

beauty in exercising my calling for love superior by far to that of exercising it for money; yet my patience fails sometimes.

[Dr. Rutty certainly had a very great interest in his profession and in the sciences that are allied to it but he earnestly tried to keep them from being his chief interest.]

[We frequently find such entries as this.]

2 .16.1755 I have fed on the tree of knowledge too much and on the tree of life too little; on corporeal medicine too much and mental too little.

4 .28.1755 It gave me some pleasure that I preferred the church work to the worldly work on principle.

1 .12.1756 Thou hast done more in the improvement of our branch of the Materia Medica than any one ordinary man but less than every christian man ought to do in spirituals; therefore slacken, slacken as to the first and tighten, tighten as to the last.

11.13.1757 Behold thy 59th year is nearly at an end and thou hast long been devoted to nature which [wo unto thee] has indeed had the preference. It is high time to give the preference to grace and to proceed in the just man's path.

12.18.1757 Do less in nature even with a sanctified indifference but do more in grace and redeem the vast treasure of time bestowed on the mere body.

6 .3 .1762 A struggle between nature and grace wherein the latter prevailed and the end of all pursuits of nature shown to be merely corporeal; not to be named with what relates to the soul and its health.

[He has some personal observations that are interesting.]

1 .22.1756 I confessed a fault to an individual I had offended, [and the next day he says]

.23. I rejoice with greater joy than that of harvest at my spiritual victory yesterday.

9 .14. A glorious introduction of prayer this day even in asking forgiveness of an individual I had offended though an inferior.

7 .24.1758 A mortifying but wholesome repulse on application to the Royal Society.

8 .17.1766 At meeting, an offense by sleeping there, rebuked with a seasonable side-blow by a woman.

[In a recapitulation of his life he says, amongst other things:]

(1718) I was transplanted to a family of friends and here a tender visitation of divine love took place in a sudden irradiation tending to stop me in my career after knowledge. Here also some inclination to marriage, but overruled by a secret hand. [He never married.]

Notwithstanding the weakness of the flesh which the good doctor records with such minute particularity and almost tiresome iteration, his "Diary" shows him to be a man of deep religious feeling with a sincere desire and effort to lead a holy life. It is refreshing to find at times that the burden of self-accusation was lifted. Especially in the silent meetings of his sect and in the quietness of his chamber his feelings, his anger, his doggedness, his alleged eating and drinking too much, his "repullulances" and his "obnubilations" are apparently forgotten and he could enter into a spiritual communion with his Maker in which a great peace descended upon him and heavenly raptures filled his soul.

4 .10.1756 A blessed time at meeting; some tears, and my heart ravished with that which is beyond outward medicine and can corroborate the inward man to resist the world.

4 .18. A blessed time at meeting; God sending forth his light and truth and love; beware of being an angel there and a devil at home.

8 .1 . A blessed time at meeting; a degree of ravishment and a clear illumination of the evidence of regeneration.

.15. The evening meeting was signally blessed to me in a sensible extension of love.

12.23.1760 At two in the morning rose and worshiped and returned to bed.

6 .18.1762 Four in the morning. Methought the time of the singing of birds was come; for I waked with a song of thanks to the Lord.

In the latter part of his "Diary" his reproaches of himself are less frequent and it is pleasant to note that his rejoicing in the belief of his regeneration is more frequently expressed. Perhaps this beautiful closing quotation will illustrate this:

> God hath favored me in temporals, with innumerable gracious providences all my life long, by giving me a sweet communion with the excellent of the earth, and in leisure to digest the labors of my youth [the review of which is pleasant] and may he render them serviceable after my death . . . Yet neglect not to offer to Him sacrifice and praise to a most gracious God who has drowned my sins in the ocean of his love.

THE HERITAGE OF PARACELSUS*

By PERCY M. DAWSON, M.D.

MADISON, WIS.

Introduction

SEVERAL years ago I presented informally a brief sketch of the life and work of Paracelsus. I recall that at the time I had a vague feeling that there was more in the subject than I had been able to catch sight of but just what it was that had eluded me I did not know.

I am no longer uncertain as to the factors which make for the true understanding of Paracelsus. I am now able to comprehend the truly amazing contrast between Leonardo and Paracelsus. For on the one hand, Leonardo made no outcry, he burned no books, but he quietly and most effectively severed all connections with those elements of the past in regard to which the scientists of today have little interest and less sympathy. Leonardo was in fact a man of our own time, lacking our knowledge, to be sure, but sharing our method and point of view. Paracelsus, on the other hand, broke with the past only with difficulty and never completely. His is a medieval character, intelligent, restless, progressive but still medieval and his life and writings must, it seems to me, be rather unintelligible to those who have not acquired some slight acquaintance with several interacting trends of thought which arose and flourished in the centuries which preceded him.

I have therefore taken it as my task to present to you certain aspects and events in the history of chemistry, alchemy, mysticism (both Christian and Neoplatonic) and of Kabbalistic theosophy.

In regard to these subjects I can make no claim to erudition or profundity but I have myself reaped so much satisfaction and profit from even a superficial survey that I have no hesitation in presenting you with my observations.[1]

Alexandria

Alexandria, the center of the known world, the center of commerce, the center of wealth, the center of learning; here flourish every sort of trade and craft, every variety of religion and philosophy and every school of medicine. Alexandria is queen not only of the Levant but of the known world, for Athens is sinking into decay and Rome has not yet reached her glory. Here amid the concourse of strange peoples and still stranger customs and in an atmosphere vibrating with conflicting opinions are three institutions which are to claim our especial attention, namely, the Egyptian temple, the Greek school, and the Jewish synagogue, and let us begin with the oldest of these, the Egyptian temple.

The Temple

It is stated that when the Greeks under Ptolemy took possession of Egypt they found in the temples a vast collection of works on pharmacy, metallurgy and the industrial arts. These manuscripts were attributed to the god Thoth and the exact nature of this literature was jealously guarded by the priests. Small wonder that this was the case since the priests claimed that through the aid of these sacred writings they were able to convert the baser metals into gold.

The question of the precious metals was one of very vital importance to the Roman emperors, who as their finances fell, debased the coinage so that their silver coin, the argenteus, was at one time made of copper coated with tin. Thus it became one of the important tasks of Diocletian, the reestablisher of the Empire, to restore and stabilize the coinage and as part of this procedure the emperor sent his officers into the Egyptian temples to destroy all manuscripts on metallurgy.

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* Read in March, 1927, before the Seminar in Medical History conducted by Prof. William S. Miller at the University of Wisconsin.

That Diocletian did not prefer to establish the imperial mint in Alexandria and to take the manufacture of gold out of the hands of the Egyptian priests, points to his skepticism with reference to the claims of the latter, a skepticism which is justified by the contents of some of the manuscripts which have come down to us and which show these priests to have been consummate rogues.

"Clean white, soft tin four times," reads one of these manuscripts, "Melt six parts of the same with one mina of white Galatian copper. It becomes prime silver that will deceive even skilled workmen who will not suppose it to be made by such treatment."[2]

These fraudulent practices imply, however, a background of not inconsiderable technical knowledge which ultimately enriched the various crafts. This knowledge spreading from Egypt reached Italy either directly or by way of the Saracens who increased it in its passage not only by increments from India but by additions of their own.

As we pass down through the centuries and come to the thirteenth, we find that the literature of chemistry can clearly be divided into two parts, the trade manuscripts, sometimes written in jargon, which was intelligible only to the initiated workman and the compilations of such encyclopedists as Albertus Magnus and other successors[3] of Pliny, the elder.

In their voluminous writings the uncritical encyclopedists mingled facts and fables most entertainingly. In one place we read of the terrible loadstone rock which drew out all the nails of the passing ships, a story familiar to our childhood as one of the adventures of Sinbad the sailor.[4] In another place we learn:

> There is a stone . . . and the description of it is that it is poison [stone]. This stone is of great dignity and nobility . . . The nature of it is warm and not very moist. It is subtle and smooth and a valuable property of it is that it cures from all poisons of whatsoever kind whether deadly or not, both from poisons that come from the earth and from those produced by the bites of worms and reptiles. It also cures wounds or snake bites . . . .[5]

Doubtless it was the fabulous and the extraordinary that appealed most successfully to the learned of the fifteenth century and even later. At that time chemistry properly so called was cultivated only by the artisans and the alchemists with hardly a notable exception.

Leonardo, with characteristic uniqueness had little respect for the philosophical chemists whom he called "lying interpreters."[6] But as a technician he was interested in industrial chemistry. In this respect he stands out in sharp contrast with the educated persons of his time. We are told that he had been commissioned by the pope to paint a portrait and that he began by preparing his materials. While engaged in boiling varnish he was visited by His Holiness who when he saw what Leonardo was doing cried out in impatience and vexation, "The man is good for nothing!"[7]

There were however besides the encyclopedias which were the delight of the learned few, the trade manuscripts already referred to, and these, favored by the introduction of printing, increased and became small trade manuals. The latter were concerned not with metallic transmutations, with theories as to the formation of metals from mercury and sulphur, with loadstone rocks and other travelers' tales nor with anything which was not severely practical.

Among those booklets which were used by the miners, mining chemists and assayers and which were printed at about 1500 A.D. or perhaps earlier, was the "Probierbüchlein." This little book went through not less than twenty-one editions in the next two hundred and fifty years. In it are described Cologne and Nürnberg balances and the making of sets of standard touch needles and then follow clear, very modern sounding directions such as this one for separating gold from silver:

> Beat the silver, in which you suppose gold to be contained, very thin, cut it in small pieces and lay it in aqua fortis [nitric acid] and set it in a gentle fire until warm and as long as it gives off bubbles. Then take it and pour off the liquid into a copper dish and let it stand and cool. The silver then settles in the copper dish. Let the silver dry on the copper dish after the liquid is poured off, and melt the silver in a crucible. Then take the gold from the glass flask and fuse that to a lump.[8]

Among those familiar with these handbooks was doubtless Bishop Erhart for he was at one time a chemist in the Fuggers' Mines at Schwatz. On the other hand scholars of the type of Abbot Trithemius would be well acquainted with the encyclopedic writings. In fact Trithemius was himself a professed admirer of Albertus Magnus.

In one of his surgical treatises, Paracelsus acknowledges his debt to both bishop and abbot. Of Ehrhart we know but little. Apparently he once taught at the Benedictine school of the monastery of St. Andreas. To Trithemius since he taught Paracelsus much more than chemistry we shall return later but not until we have several times revisited ancient Alexandria to which we shall now return.

THE SCHOOL

The Greek philosophers of Alexandria had brought from Athens their traditions and their learning. Their minds were still dominated by the divine Plato. As they perused the dialogs, they found such passages as the following:

> Apart from fire and light, nothing could ever become visible, nor without something solid, could it be tangible . . . therefore did God when he set about to frame the body of the universe, frame it of fire and of earth. But it is not possible for two things to be fairly united without a third, for they need a bond between them which shall join them both. The best of bonds is that which makes itself and those which it binds as complete a unity as possible, and the nature of proportion is to accomplish this most perfectly. For when of any three numbers . . . one is a mean term, so that as the first is to the middle, so is the middle to the last, then since the middle becomes the first and the last, and the last and the first both become the middle, of necessity, all will come to be the same and being the same with one another, all will be a unity.
>
> Now if the body of the universe were to have been made a plane surface having no thickness, one mean would have sufficed to unify itself with the extremes, but . . . since solids can never be united by one mean, but require two, God accordingly set air and water betwixt fire and earth, and, making them as far as possible exactly proportional, so that fire is to air as air is to water, and as air is to water so water is to earth, thus he compacted and constructed a universe visible and tangible.[9]

One wonders how Empedocles would have felt had he ever known what was to happen to his four elements at the hands of posterity.

The divine Plato states moreover that there are many kinds of fire and water and of the other elements. These names express rather great categories of materials than anything more specific. Nor is it impossible for one element to pass over into another as we may see in respect to that which is now water, now a solid and again bears the character of air. Thus we may see that under proper conditions a substance may pass over from one category into another.

THE ALCHEMISTS

To minds cast in this mould there was nothing inherently absurd in the claims of the Egyptian priests. True the Greek philosophers could not hear tales of the transmutation of lead into gold with an unqualified credulity. They saw in Thoth their own god Hermes, who was, among other things, the patron of thieves. But there were surely some honest men among these priests and what they had achieved others could achieve especially with the aid of this "Hermetic" literature.

Thus there grew up a class of men who devoted more or less of their time to the invention of metallurgical processes and the application of these to the problem of metallic transmutation and a body of tradition grew up which taught that gold is the most perfect of metals and the goal of the Creator's thought; that all other metals are imperfect gold, that in purifying them lies the essential task, the task of completing the Great Work which God has begun. Moreover the human body, like the baser metals, requires purification and a divine elixir, which will cure all bodily ills, awaits discovery through the labors of the experimenter and the sage.

Success in this Great Work will surely never be achieved by base persons. Diligence is not the only requisite of success; to it must be added a life of aspiration, of self discipline, of self consecration; with a knowledge of the Hermetic books there must go, hand in hand, an abundance of divine grace.

Such was the Greek philosopher turned chemist, in other words the alchemist, whose lore passed over into the keeping of the Moslems, to be augmented and passed on to Europe of the earlier (twelfth century) Renaissance.

Just as the goal might not be reached, save by the blessed, so the steps taken by the alchemists might not be displayed to the gaze of the vulgar and so a form of cryptic writing grew up whereby the true sense was concealed from all save the initiated. Thus Theophrastos, who versified in the ninth century the equally cryptic prose of Stephanos who wrote two hundred years before, tells us:

A dragon springs therefrom which, when exposed
In horse's excrement for twenty days,
Devours his tail till naught thereof remains.
This dragon, whom they Ouroboros call,
Is white in looks and spotted in his skin,
And has a form and shape most strange to see.
When he was born he sprang from out the warm
And humid substance of united things.
The close embrace of male and female kind
—A union which occurred within the sea—
Brought forth this dragon as already said;
A monster scorching all the earth with fire,
With all his might and panoply displayed,
He swims and comes into a place within
The currents of the Nile; his gleaming skin
And all the bands which girdle him around
Are bright as gold and shine with points of light.[10]

And so the poem continues on and on. Just once do we see a substance mentioned by its common name, when we are told "then pour the mercury." All the rest is left for those to interpret who can.

If prayer and holy living could have availed, if industry and devotion could have been crowned with success, the toilers of the laboratory would have led mankind into the promised land.

At any time the devotee might have turned aside to produce sham gold. Undoubtedly the experience of Denys Zachaire was not an unusual one. He writes:

> On my road, I heard of a man of religion who was wise in natural philosophy and went therefore to visit him, but only to be diverted by his earnest counsel from all modes of sophistication, over which I had wasted my time . . . I was rather to study henceforward the books of ancient philosophers, that I might become acquainted with their True Matter, wherein was the perfection of the science . . . I began again to frequent those who were pursuing the Divine Work, not, however, my old acquaintances . . . who were dabbling in sophistications.[11]

The temptation was always there and it is to the credit of humanity that there were apparently so many who would not yield to it.

Thus the Great Work, alchemy, passed down through the centuries and found in Italy of the Renaissance a much warmer welcome among the educated than did its more substantial though less alluring sister, technical chemistry.

NEOPLATONISM

Now besides deriving most impractical notions from those most practical persons the Egyptian priests, the Greek philosophers in Alexandria did some real thinking of their own in regard to the difficulties raised by the metaphysics of their master Plato. For Plato would have it that the phenomenal world is but the imperfect representation of the real world of ideas, or prototypes, and it seems to have been difficult for his later followers to conceive of these shadowy patterns of things existing always and yet nowhere in particular and to imagine the way in which such patterns might connect with a world of phenomena. Therefore these spiritual descendants of the Athenian Academy developed and extended the doctrines of Plato becoming by so doing Neoplatonists. These Neoplatonists solved one of the problems just alluded to by placing the patterns in the mind of God and the second problem by bridging the gap between the patterns and the objects before us by means of mediating links.

Thus according to Plotinus there emanates from God, who is beyond everything, even being, an overflow as it were, known as Mind [Nous], from which there is a second emanation, Soul, the universal Soul or Over-soul.

Besides the intellectual alteration in Plato's scheme, the Neoplatonists developed or adopted from the Orient a technique whereby each one of us may come to experience God directly.

There are two steps in this approach to the Supreme Being. By the first we become plunged into thought, we transcend the soul and enter the realm of mind. We move among the archetypes and think God's thoughts with Him. In the second step we progressively deny all sense impressions until the soul becomes caught up by the divine dark or nothingness which signalizes our absorption into the Deity.

Apart from any claim to logical derivation or internal consistency which Neoplatonism might advance, the charm and beauty of its conceptions enthralled many of the finest minds and these soon became distressed and angered beyond measure by the rise of a new group, a new school of philosophy and religion.

CHRISTIANITY

This new upstart was Christianity which had already outgrown its primitive communism, pacifism and its naïve anticipation of an impending judgment. Although it now could boast of its scholars, it still claimed to be essentially the religion of the oppressed and with it Neoplatonism soon closed in a struggle which was unworthy of either, a struggle for the capture of political prestige.

Each angrily accused the other of plagiary and indeed they did have much in common. They agreed essentially as to the nature of God and of the world and of the relation which exists between the two, and they also agreed as to the nature of evil and of freedom. They differed, however, in respect to the incarnation and the resurrection, and to the Christians these differences were of overwhelming importance. Theirs was a religion of salvation; they sought a guarantee of celestial favor which they could not find in Neoplatonism. True the Christian mystics like the Neoplatonists derived their sanction from ecstacy but the ordinary people demanded assurance through historical tradition.

Hence the wrath of St. Augustine, himself not exempt from mystical leanings, who called the Neoplatonic philosophers the "deceivers of the deceived"; their philosophy, magic, and their method, incantation.

With the death, in 363, of Julian whom the Christians called "The Apostate" the triumph of Christianity now radically transformed, became assured. In 415 Hypatia was torn to pieces in the market place of Alexandria. And in 529 the schools of the Greek philosophers were permanently closed by the Emperor Justinian, just as the temples of Aesculapius had been closed by Constantine two centuries earlier [335 A.D.].

Meanwhile the now chastened Neoplatonism had passed over into Syria to become absorbed later into the culture of the Arabs, or it lay dormant in the works of its great masters Plotinus and others to be reawakened by the Renaissance, or lastly it passed over directly into Christianity and served to reenforce the mysticism already cultivated by the Christian saints.

That this transference occurred not only gradually but sometimes in truly massive manner the following story shows.

At a conference with the Severians,[12] called by Justinian in 533 [or 531], the members of this sect of Christians asserted that Christ had a single nature. Judged from the scholarly standpoint such a statement must be erroneous for as every well-informed person knew copper and silver cannot be united by being merely melted together. They can be united only through the intermediary agent, mercury, and furthermore this mercury acts as it does in virtue of its sharing the properties of both silver and copper since in some of its forms [quicksilver] it resembles silver while in others it has the red color of copper.[13] Examples of this sort might be multiplied indefinitely. Indeed they are but special applications of the more fundamental doctrine of the nature of the union of earth and fire. Thus we may clearly see that there can be no reconciliation between God and man, no hope of salvation unless Christ also possesses two natures, divine and human.

However, the Severians stood firm and in support of their views produced manuscripts which they alleged had been written by one Dionysius, the convert of Paul in the Areopagus, the first Bishop of Athens, the companion and friend of the apostles.

The opponents of the Severians, of course, denied the authenticity of the books and in the end won the day. But the books themselves became popular almost immediately and from the beginning of the seventh century were accepted by the Eastern Church.

In 827, a set of the Dionysian writings was sent to Louis I, son of Charlemagne, who turned them over to the Abbey of St. Denis, near Paris. By a confusion either unconscious or intentional, Dionysius, the Areopagite, was identified with St. Denis, the martyr and patron saint of Paris. But in spite of this mistake the acquisition of these books was at once signalized by miracles. Unfortunately as the books were in Greek no one could read them, but at length Charles the Bald (843–876) ordered their translation by John the Scot who not only accomplished this but went on to write books of his own showing himself to be one of the greatest mystics of the Middle Ages.

A few extracts from Dionysius will show the tenor of his thought:

> We ought to know that our mind has the power for thought, through which it views things intellectual but that the union through which it is *brought into contact* with things beyond itself surpasses the nature of mind. We must, then, contemplate things Divine by *union*, not in ourselves but by going out of ourselves entirely and becoming wholely of God.[14]

And again, addressing the New Testament character:

> O dear Timothy, by thy persistent commerce with mystic visions, leave behind sensible perceptions and intellectual efforts, and all objects of sense and of intelligence, and all things being and not being, and be raised aloft above knowledge to union, as far as is attainable, with Him who is above every essence [or attribute] and knowledge. For by a resistless and absolute ecstacy from thyself and everything, thou wilt be carried up to the superessential ray of the Divine Dark, when thou hast cast away all and become free from all.[15]
>
> Just as those who make a lifelike statue chip off all the encumbrances, cut away all superfluous material, and bring to light the Beauty hidden within. So we abstract [negate] everything in order that *without* veils we may know the Unknown which is concealed by all the light in existing things.[15]

All this is essentially like Plotinus. The ladder also is preserved albeit the rungs are named differently; instead of God, Mind [Nous], Over-soul, we have a triple trinity in (1) seraphim, cherubim, thrones, (2) dominations, virtues, powers, (3) principalities, archangels, angels. Whence this extraordinary complexity? Whence? Why that comes probably from the synagogue in Alexandria. Let us therefore hurry back again to Alexandria.

THE KABBALA[16]

In the Jewish synagogue as well as in the Greek school the intellectuals were encountering difficulties. It is obvious that the more spiritually minded and philosophical rabbins who perused lovingly the rolls of the scriptures should have found many passages which were most disappointing. If these rolls contain only the most subtle, the most exalting, the most soul satisfying of spiritual food, what can be said of passages such as those which describe the conduct of Lot's daughters, the outrage at Gibea, and of many others, which seemed either grotesque, contradictory or simply commonplace and stupid? The answer is obvious. For, as the alchemists concealed their thought in words which meant something quite different from their face value and hence can be understood only by the initiated, so the holy and inspired writers of these sacred rolls have written with a double meaning, the obvious for the simple, the profound for the wise. It became necessary therefore for the wise to seek and discover these hidden meanings, and the text of the scripture thus became a cipher for the solution of which at least eight well-defined methods were devised.

Among the latter was that of giving to every letter of a word its numerical value and then explaining this word by another whose letters add up to the same quantity. Thus the Kitzur Sh'lu reads:

> It is written, this is My name, and this My memorial. My name, together with the letter Yeho, amounts numerically to 365; the letter Vah together with My memorial, amounts to 248. Here we have 613 which is the number of the precepts of the law. The soul is a portion of God from above, and this is mystically intimated by the degrees of breath, spirit, soul, the initial and final letters of which amount to 613, while the middle letters of these amount to the number of Lord, Almighty, God. The soul of Moses our Rabbi, peace be on him! embraced all the souls of Israel; as it is said, Moses was equivalent to all Israel. Moses our Rabbi amounts to 613; and Lord, God of Israel also amounts to 613.
>
> May good omen and good luck be upon us and upon all Israel! Amen![17]

Such methods of exegesis although repellent to the severely rational mind have been very prevalent in Christian thought. We find them not only in Swedenborg and Mrs. Eddy but also among the more orthodox who seek to impose upon words and phrases meanings which accurate scholarship would discredit.[18]

It was this discontent then with their scriptures as they stood which stimulated the rabbins to seek and find the following in the Hebrew bible:

God the infinite, the boundless, is above all and beyond all; even being and thinking are attributes too finite to be affirmed of him. He cannot indeed be comprehended by the intellect nor described in words. His name is En Soph [Without End, The Infinite].

Of course a being whose essential characteristic is infinite emptiness cannot create but even from the beginning there existed in him [strange contradiction] the will to become known. The first manifestation of this will, coeternal with the Inscrutable, is the first Sephirah or emanation. Within this Sephirah are contained nine other Sephiroth derived serially one from another. These ten intelligences proceed like rays from the En Soph. Together they are called the heavenly or archetypal man. They were what Ezekiel saw in the mysterious chariot and of them earthly man is but a faint copy.

The natures of these separate intelligences are known through their names. 1, The

Crown, 2, Wisdom, 3, Intelligence, 4, Love, 5, Justice, 6, Beauty, 7, Firmness, 8, Splendor, 9, Foundation, 10, Kingdom.

Here is a trinity of triads plus the Kingdom which is the schechinah or halo which surrounds them all. There is also to be extracted at least two more trinities, a trinity of units and a trinity of characters.[19]

At once we are impressed with the likeness between this celestial ladder and those of Dionysius and of John the Scot. I cannot say with certainty whether Jewish or Christian mystic influenced the other more in the process of complexification of the simple celestial linkage of the Neoplatonists. Certainly both Jewish and Christian influences are brought to bear upon the ladder building tendencies of later times.

But to continue our exposition of rabbinical lore; the world was not created out of nothing. It is the unfolding of the Sephiroth and it is a fourfold world. First there is the world of emanations filled with the unborn souls of men, secondly, the world of creation, where the angel Metatron, "the garment of Shaddai," rules all the worlds below him, namely, the third world, the world of formation inhabited by the angelic hosts and lastly the fourth world, the world of matter, our world.

Man is a microcosm, he unites in himself all forms, indeed each member of his body corresponds to a part of the visible universe.[19] What oriental heritage is this, for man was a microcosm not only to the medieval Kabbalists but also to the ancient Chinese![20]

Such was the work of the rabbins who wrought the Kabbala and these secrets, the learned carried with them into the Moslem world and then into Europe prior to the Renaissance. But at first it was no easy job for the Christian scholars to persuade the reticent sages to speak of these mysteries of their religion and to unfold the complexities of the Kabbalistic theosophy.

ITALY

Italy in the fifteenth century! There had been nothing like it except among the Saracens since the ancient glories of Alexandria! Here in Italy was again the meeting place of all cultures and all varieties of thought. No longer was Italy solely dependent upon Arab translations for its learning for its scholars had begun to unlock the secrets imprisoned in Greek manuscript. To the civilization of Italy, the Egyptian temple had contributed its impulse greatly enhanced by its passage through the Saracens to metallurgy and the industrial arts. Here alchemy was pursued with vigor, albeit under the suspicion of the Church. Here Jewish doctors might be found versed in Kabbalistic and Talmudic lore which they were none too eager to impart. Here too is the Christian mystic the most dreaded ornament of the Church. For because of his direct access to the Deity, the mystic is likely to become careless of the ministrations of the Church. He is likely to neglect his duty of holy obedience and to place the authority of his own revelation before that of the institution which is itself the clearest and most explicit revelation of the divine will. Do not all heresies and schisms begin with the mystics?

THE FLORENTINE ACADEMY

It was in 1439 that a council met in Florence to discuss and, if possible, to accomplish the union of the Greek and Latin Churches. It was indeed a vain hope but something grew out of that council a by-product of a most unexpected nature. It happened in this way.

Among the participants at the council was a certain Gemistos Pletho [c. 1355–1450], a Greek.[21] This man was versed in the writings of the Neoplatonists and the Neopythagoreans. He was a dreamer who had imagined a semi-pagan philosophy superseding Christianity and the resurrection of the old Athenian Academy where Plato had walked and talked among his alert and appreciative pupils. As for Gemistos himself, the Florentine literati called him the second Plato.

Time past and others began to take up the dream of Gemistos and among these was Cosimo de Medici, who with characteristic vigor founded at one stroke the Florentine Academy.

Here the young men would learn by way of pastime precepts of conduct and the practice of eloquence. The older men would discuss the government of the family and of the republic. The aged would seek consolation in such themes as immortality. There were patrons [the Medici], hearers [the body of the organization], and disciples [the youths already mentioned].

It was a grand idea and so successfully carried out that other Academies began to crop up as in Rome and in Naples.

But there is one thing which an organization of this type must have and that is a permanent, responsible, talented person who will serve as an executive officer, a standard bearer in the company of scholars.

Now it happened that about this time a young man by the name of Marsilio Ficino had begun to attract attention. He was the son of Cosimo's physician and the close friend of that other promising youth Cosimo's own son, Lorenzo, and, although his health was poor, he possessed rare gifts of mind. So Cosimo made him the hierophant of his new academy, where he set to work and translated Plato, Plotinus and Dionysius the Areopagite. Indeed he became so diligent in his labors that overzealous persons denounced his activities to the ecclesiastical authorities.

It seems to have been one of the regular duties of the Popes in those days to protect such scholars as were accused of heresy, magic, and impiety but who were at heart loyal to the papacy. So Ficino was acquitted and continued his labors living in a beautiful, rural retreat not far from Florence, a pure, simple, lovely character, encyclopedic in knowledge and possessed of a vast number of learned acquaintances.

Now who were the men whose names are associated with the Florentine academy or who, we may suppose, dropped in occasionally while passing through Florence?

There was his eminence, the cardinal, Nicolaus of Cusa, the son of a poor fisherman, who on his journeys to and from Germany and the Netherlands, whither he was sent to restore purity and respect for the rule in the monasteries, must certainly have tarried at the academy. He would be welcomed, as a sign of ecclesiastical sanction, to their proceedings so often made the theme of unpleasant comment by the pious and illiterate. He would also be welcomed as a scholar for had he not followed Laurentius Valla in attacking the "Donation of Constantine" and then along with Juan Torquemada been the first to cast doubts upon the genuineness of the False Decretals? Was he not a good Neoplatonist since he believed that all human knowledge is conjecture and that God may be reached through intuition? And although he held the queer notion that the earth rotates, he was certainly a good Pantheist too. "Philosophy" said he, "is the religion of the learned; religion the philosophy of the simple," or words to that effect. And yet in spite of all this liberalism he was made governor of Rome during Pope Pius's absence.

Among the attractive figures in and about the Academy was a gay Italian nobleman, tall, fair, handsome with grey eyes and yellow hair, a great favorite with the ladies. It is Count Giovani Pico della Mirandola who, though thirty years younger than Ficino, became his closest friend.

Pico too had his troubles for once a book of which he was the author was burned by order of the Pope. Once he was acquitted of heresies such as saying that the Kabbala gives proof of the deity of Christ. But surely he ought to have known for he was acquainted not only with Latin but with Hebrew, Arabic and Chaldee which he had acquired from most accomplished teachers and he had studied the Kabbala profoundly before making the statement for which he was censured. Thus it would seem that he read into the Kabbala his own desires, even as the rabbins had read theirs into the Hebrew Scripture.

THE GERMANS

In 1482 there arrived at the Academy, a strange scholar from the Black Forest. He had come to Italy as the interpreter of Count Eberhard of Würtemberg. It was Johann Reuchlin. He was a very learned man and knew both Greek and Hebrew and he soon found a kindred spirit in that other Hebrew scholar Pico della Mirandola who, as we have seen, was one of the noted Kabbalists.

Soon Reuchlin also was finding in the Kabbala a defense of Christianity. But he found much more than this in his Hebrew studies. They became of absorbing interest to him and when an attempt was made in the cities along the Rhine to burn all the Jewish books he stoutly opposed the attempt. For this he was denounced and summoned to Rome but, being a good Catholic, he was acquitted.

Reuchlin's reputation for learning brought to him many pupils among whom was Oecolampadius who later became professor of theology at Basel and active in the Protestant Reformation. He was the friend of Erasmus and Frobius and supported Paracelsus during his brief and stormy sojourn at the university.

Another pupil of Reuchlin was his sister's grandson Philip Schwarzerd. However, he too went astray and joined the Protestants and as a writer and reformer is known by his Greek name Melanchthon.

Besides those who actually visited Florence there were many who experienced the influence of the Florentine Academy either through the inspiring contact of such returned travelers as Reuchlin or through the writings of the academicians themselves.

Thus Johannes Trithemius made the Benedictine monastery of Sponheim near Kreuznach an educational institution of the first order, noted for its excellent library, strict discipline and consummate scholarship. Trithemius himself was a chemist, alchemist and Kabbalist. He was also the first important writer on cryptography.

In 1506 he exchanged his abbotship for that of St. Jacob at Würzburg and here it was that Paracelsus became his pupil.

Among the friends of Trithemius was Agrippa von Nettesheim a traveler, writer, soldier, physician and magician. He wrote on occult philosophy and a defence of magic as a means of knowing God. Agrippa taught a modification of the Kabbalistic cosmology in which there were three worlds instead of four, namely the celestial, siderial and the material.

In these worlds there exists the Agrippan analogue of the Dionysian or Kabbalistic ladder, a sort of hierarchy of power. At the top stands the prototype, at the bottom, man; and between them in descending series each member dominated by the power above and dominating the power below come Angels, Heavens, Stars, Elements, Animals, Plants and Rocks. Through natural magic, man may at least in part reverse this control, and by natural magic Agrippa means physics, mathematics and theology.[22]

How strikingly familiar all this sounds! Indeed the system of Paracelsus cannot be fully appreciated apart from that of his master's friend Agrippa whom he followed in many respects. When Agrippa says "All chemists are either physicians or soapboilers" his remarks sound very much like some of Paracelsus'.

PARACELSUS

It is easy to see the value to Paracelsus of his inheritance from the industrial chemists and the alchemists but what could have been the advantage to him of all this mysticism of threefold origin Christian, Neoplatonic and Kabbalistic with its intuitions and ecstacies, its celestial ladders and its endless irrational complexities and absurdities? The answer is not far to seek.

We have seen in the medieval Christian

church two antithetical tendencies, the ecclesiastical and the mystical.

The policy of ecclesiasticism demands that there be a series of divinely attested dogmas whence all things may be deduced. The ecclesiastical method is logical and is followed unswervingly. It may lead to a doctrine of predestination or to the immaculate conception but the method cannot be abandoned except under dire necessity and then the appeal must not be made to the uncontrolled, unlicensed mystic but to some generally recognized source of divine guidance, a council, a pope, or a book.

To be sure the saints may communicate directly with the Deity but the divine message in passing through them may undergo immeasurable distortion, while through the council, the pope, or the book come clear-cut, authentic, validated statements of the Divine Mind.

The essentials of ecclesiasticism, however, are not characteristics which are confined to the sacerdotal orders. They are human characteristics and in medieval science there was exactly the same antithesis as in the medieval church.

It must be remembered that the Aristotle of the Renaissance was not the Aristotle of Theophrastus nor of William Harvey; he was the medieval Aristotle. For just as the middle ages had transformed the poet Virgil into a magician and wonderworker,[23] so had Aristotle been made to assume the rôle of doctor infallible, writer of patristic literature and [significant difference!] not the master of those who seek but the master of those who *know.*[24]

Thus it came to pass that in fifteenth century science, there stood on the one hand the rationalistic classicism of those scientific schoolmen, the Aristotelians and the Galenists, with its dogmas, its deductive logic and on the other hand stood those scientific mystics, champions of the direct appeal to Nature, who is to be approached not with obsequiousness to tradition and dialectic subtleties but through astrology, alchemy, magic and patient observation. What a flood of light do these considerations throw upon the bonfire of authorities kindled by Paracelsus at Basel!

It was the triumph of mysticism over ecclesiasticism, of saint over priest, of Neoplatonism over Neoaristotelianism, and Paracelsus being a medievalist [unlike Leonardo] could triumph in no other way than by using a medieval tool to cut his medieval bonds. Fortunately also the chemistry and alchemy, which Paracelsus knew so well, saved him from that most paralysing element in Neoplatonism, the belief in the futility of human knowledge. Thus Paracelsus was enabled to pluck the rose of mysticism while avoiding its thorns.

That Paracelsus should also have been caught up in the stream of the Protestant Reformation is but natural for do not all heresies begin with the mystics?

Erhart, the bishop, Trithemius, the abbot, Agrippa, the physician, along with Wilhelm Bombast von Hohenheim [of whom we know so little], these are they who opened the door of the past to Paracelsus. It was Paracelsus himself who opened for himself and other children of Medievalism the door of the future.

NOTES

1. In my desire to avoid making any of those monumental blunders which sometimes mar the presentation of matters with which one is all too unfamiliar, I have submitted my manuscript to the criticism of several of my non-medical colleagues. It is certainly a pleasure and, I think, a duty to express my thanks to Professors W. J. Chase, A. R. Hohlfeld, E. H. Byrne, E. Kremers, and A. E. Haydon.
2. BROWNE, C. A. The poem of the philosopher Theophrastos upon the sacred art: a metrical translation with comments upon the history of alchemy. *Scient. Month.*, 1920, x, 202.
3. *e.g.* Bartolomaeus Anglicus, Vincent of Beauvais, and perhaps Roger Bacon might be included.
4. Twelfth century writer trans. by Valentin Rose (*Ztschr. f. deutsches Alterthum*, 1875, Vol. XVIII) whom J. M. Stillman quotes (The Story of Early Chemistry, N. Y., 1924, p. 209).

5. Stillman, J. M. The Story of Early Chemistry, N. Y., 1924, p. 206.
6. McCurdy, E. Leonardo da Vinci's Note-books. N. Y., 1923, p. 55.
7. Raab, F. Leonardo da Vinci als Naturforscher. From the Sammlung gemeinverstandlicher wissenschlaftlicher Vorträge herausgegeben von Virchow und von Holtzendorff. Series 15, Heft 350. Berlin, 1880, p. 19.
8. Stillman, J. M. The Story of Early Chemistry, N. Y., 1924, p. 306.
9. Plato. Timaeus; trans. of R. D. Archer-Hinds, 1888, quoted from Stillman, J. M. The Story of Early Chemistry, p. 146.
10. Browne, C. A. The poems of the philosopher Theophrastos upon the sacred art. *Scient. Montb.*, 1920, x, 204.
11. Waite, A. E. The Secret Tradition in Alchemy, N. Y., 1926, p. 192.
12. For this "collatio cum Severianis" see Encyclopedia of Religion and Ethics, edited by James Hastings, article Monophysitism by G. Krüger 1916, viii, 815, d.
13. Browne, C. A. The poem of the philosopher Theophrastos upon the sacred art. *Scient. Montb.*, 1920, p. 206.
14. Jones, R. M. Studies in Mystical Religion, 1909, p. 108.
15. Jones, R. M. Studies in Mystical Religion, 1909, p. 109.
16. Oesterley, W. O. E. and Box, G. H. A Short Survey of the Literature of Rabbinical and Mediaeval Judaism, N. Y., 1920.
17. Hebraic Literature: Universal Classics Library; Dunne, New York, p. 271.
18. "The Old Testament is a cipher," writes Blaise Pascal in his "Thoughts" (chapter entitled "Thoughts on Mohamet and on China") and he frequently reverts to this idea.
19. Ginsburg, C. D. and Cook, S. A. Article on Kabbalah. Encyclopedia Brit., ed. 11.
20. Dawson, P. M. Su-Wen, The Basis of Chinese Medicine. Annals of Medical History, 1925, viii, 59.
21. For the biographies of Pletho, Ficino, Pico, Cusa etc. and for the description of the Florentine Academy, I have drawn freely on the numerous articles and cross-references to be found in the Encyclo. Brit. ed. 11.
22. Stillman, J. M., Theophrastus Bombastus von Hohenheim called Paracelsus. Chicago, 1920, p. 31.
23. Comparetti, D. Virgil in the Middle Ages; trans. E. F. M. Benecke, also Karl Shambach: Virgil ein Faust des Mittelalters, 1904.
24. Dante 's Inferno, Canto iv, line 131.

A FIFTEENTH CENTURY AUTOPSY BY BERNARD TORNIUS

By LYNN THORNDIKE, PH.D.

NEW YORK

IN the following pages I reproduce from a manuscript in the Riccardian Library at Florence[1] the first-hand account, by the family physician in charge, of an autopsy and medical inferences therefrom, the same dating from the second half of the fifteenth century. The author is Bernard Tornius, who lived from about 1452 to 1497, and who stood well in the estimation of his medical contemporaries. Of his treatise on the preservation of health ("De tuenda sanitate") I have treated elsewhere.[2] A work "On Lenten Food" ("De cibis quadragesimalibus") and a medical "Consilium," written for Philip Decius of Padua, are also ascribed to him. It does not seem likely that the last-named is identical with the post-mortem examination and medical advice which we are now to consider.

Our present treatise is the fifth of eleven "Opuscula" by Tornius contained in the Riccardian manuscript, a small codex of which our treatise covers five pages written in a small and abbreviated but neat hand. The other Opuscula are partly medical and partly philosophical in character. The first treats of the nature of the juice of wormwood and whether it is good for quartan fever. Next there are conclusions concerning fevers, then some propositions concerning different constitutions or states of health, and fourth, some charts or outlines connected with the primary qualities in general and heat in particular. Following our treatise, which is described in the table of contents upon the fly-leaf of the manuscript as "An Anatomical Relation," there are two letters. The first deals with problems of motion suggested to Bernard's mind by the noted writers on mathematics and physics, John Marlianus of the fifteenth century, and Richard Suiseth of the fourteenth. The second, addressed to Master Franciscus Ninus, deals with blood letting and pharmacy. In the eighth Opusculum Tornius argues against three of the nine hundred theses which Pico della Mirandola, at the age of twenty-one, had offered to defend at Rome against all comers. The first is the twentieth, of those taken from the writings of Aquinas: That it is not in God's power to have the same body in different places at the same time. The second is the fortieth of those drawn from the works of Aristotle: That difficulty in understanding may come in part from within and in part from the thing to be understood. The third is the forty-third of the same: That there should be matter without form, implies contradiction. In the ninth and tenth items Tornius discusses with Master Franciscus of Siena the thesis: No state of health always is health absolutely. In the last entry, dated 1485, Tornius culls some definitions of bodies from the words of "More than Commentator," that is, from Pietro de' Torrigiani, author of the medieval medical work of that title.[3] Whether we may infer from the date of this last entry that all the other preceding Opuscula were composed previously is perhaps questionable, although a natural inference. The nine hundred theses of Pico were proclaimed about the year 1483, so that Tornius might well have argued against them before 1485.

From most of these other Opuscula our impression of Bernard Tornius would be that of a person much given to the current scholastic disputation, although with a breadth of interest extending beyond the strict field of medicine into those of physics, philosophy, and even theology. In his longer work "On the Preservation of Health," moreover, he appeared as a somewhat bookish individual who contented himself with a compilation from past writings and spoke slightingly of rash medical experimentation. But in his account of the autopsy we see him in the new light of a medical practitioner acquainted with dissection and the anatomy of the human body, and as a sympathetic family physician.

This post-mortem examination shows us more than that. Too often have we been told, with little or no evidence adduced to support the charge, that religious prejudice operated to prevent dissection of the human body in the Middle Ages. Now it is recognized that "anatomies" in the shape of systematic dissections of bodies for purposes of instruction were held regularly in the schools of medicine of the fourteenth and fifteenth centuries, and the skill of practicing surgeons of the same period is becoming better known. The bodies used in the university dissections were commonly those of executed criminals or other outcasts; the surgeons usually would treat only those cases where they thought that recovery was likely. In the present autopsy, on the other hand, we find a physician of note recommending, and a high official, presumably of good family, social standing, and considerable property, agreeing to a post-mortem examination of the vital organs of the official's own son, with the aim to discover if the complaint of which he died was of hereditary character and so to prescribe more intelligently for the other children of the same father. No doubt the advancement of science and the promotion of human health in general, by investigation of a disease which, as he says, is "not yet fully understood by doctors," were further motives which actuated Bernard Tornius. He does not however obtrude these motives upon the afflicted father.

The report of the physician upon the autopsy which he has conducted is marked by two qualities which are far more characteristic of medieval thought and expression than is generally recognized, namely, clearness and directness. After a tactful word of sympathy to the bereaved parent, he concisely reviews the results of the post-mortem examination, then briefly enumerates his five findings as to the nature of the disease. He also explains, in clear detail, the diagnosis and reasoning by which he reached these conclusions. Finally he suggests a prophylactic treatment for the remaining children, with the intelligent proviso that it may need to be varied according to time and circumstance by the attending physician. He expresses his intention to acquaint himself better by frequent visitation with the other children. Some of the details may seem quaint and amusing today, and of course Galen and Avicenna are cited, but across the intervening centuries this brief, scientific, human document carries a vivid conviction of reality, transporting us as by some magic carpet back into the very midst of the medical theory and practice of long ago. In modern medical phraseology the autopsy seems to have revealed that the boy suffered from multifold metastatic abscesses of the liver, the result of septicemia or pyleophlebitis. But let Bernard Tornius speak for himself. I give both the Latin text and an English translation.[4]

Notes

1. Riccard. 930, fifteenth century, paper, 38 fols., "Bernardi Tornii Florentini Opuscula Medica." Our treatise occupies fols. 17v–19v.

2. Lynn Thorndike, "Some Minor Medical Works of the Florentine Renaissance," *Isis*, 1927, IX, 29–43. The "De tuenda sanitate" is found in another manuscript at Florence in the Laurentian library: Laurent. Plut. 73, cod. 34, fifteenth century, 90 fols.

3. "Trusiani monaci cartusiensis plusquam Comentum in librum Caleni qui Micro techni intitulatur, Ugo Ruggieri," Bologna, 1489; also printed at Venice, 1504, 1517, 1526, etc.

4. My thanks are due to Professor T. Wingate Todd, of the department of anatomy of Western Reserve University, and

to Professor James H. McGregor, of the department of zoology of Columbia University, for kindly assistance in interpreting the medieval anatomical terminology.

Relatio Anatomica of Bernard Tornius

[M]agnifice pretor, doleo vices tuas, prolem namque admictere malum, deterius marem, pessimum egritudine nondum a medicis plane percepta. Verum pro reliquis aliis existimo sua vidisse interiora maxime fore utilitati[s]. Nunc ergo brevius quam potero quorum vidimus in medium afferam et que credo concludam remediaque meo iudicio proficua adducere non dubitabo.

In primis apparuit venter satis tumidus quamvis gracile mirac fuerit. Scisso vero secundum regulam mirach et sifach vidimus intestina et vesicam que turgida urina plena erat, removendo insuper colon et saccum magis in eis apparuit ventositas grossa quam feces. Deinde remoto yleon et jeiuno et duodeno intestino duo vermes reperti sunt satis magni et albi flegma ostendentes potius quam alium humorem. Abscissis intestinis a mesenterio,[1] quoniam ibi nihil notabilis repertum sit, videntes vesicam turgidam scindere ipsam feci et apparuit quantitas urine magna licet ante mortem ut retulerunt multum minxerit. Vidimus postmodum epar quod maculis quibusdam tamquam ulceribus erat dispositum et circa principium vene chilis aliqualiter tumefactum. Sed quod magis est mirandum, apparuit circa originem venarum emulgentium in concavitate vene chilis oppilatio manifesta qua tota concavitas humore viscoso repleta erat per spacium grossitudinis unius digiti, post quam humorem infra nihil sanguinis videbatur, vene vero emulgentes replete erant sanguine satis aquoso et renes tumefacti pleni erant huiusmodi sanguine vel forte multa aquositate urinali admixta cum eo. Chilis autem ascendens habebat ramum ad cor tractum[?] repletum multo sanguine, et cor erat valde tumefactum, itaque etiam auricule tumide supramodum apparebant. Quibis scissis maxima pars sanguinis exivit ita quod quasi totus sanguis circa partes cordis fuit repertus. Vena vero que tracta est ad pulmonem deferens (fol. 18r) sanguinem nutrimentalem ei plena etiam erat humore consimili viscoso et tota exanguis videbatur. Quibus visis non amplius quesivi de re alia cum apparuerit meo judicio causa sue mortis. . . .

Ex his infero primo puerum talem vel a principiis nativitatis vel ex tempore magnam oppilationem contraxisse, probabiliterque tenendum est magis per paulativam congestionem quam per defluxum ab alio membro factum huiusmodi materiam esse cumulatam.

2° infero vermes illos post principium sue egritudinis principalis fuisse genitos neque aliquo pacto fuisse causam sue mortis.

3° infero quod prohibita transmissione sanguinis per venam chilis et per venam pulmonis facta est ebulitio et febris. Et quia in illo sanguine multum erat de flegmate, febris illa in multis accidentibus assimilabatur flegmatice, licet secundum modum invasionis et excrescentie videbatur tertianae due. De tertio enim in tertium magis infestabatur in nocte ut abstantes referebant et ego infero manifeste ex inquietudine sua et pulsu percipiebam.

Infero 4° maculas illas epatis post oppilationem esse generatas.

5° et ultimo infero quod quilibet filius tuus eiusdem complexionis usque ad 12m annum est preservandus cum medicinis usualibus quas in fine afferam.

Primum corollarium breviter patet ex his que oculis vidimus. Inquit enim Galienus 6° terapeutice oportet ut prius consideranda considerentur deinde cum experimento certificentur ut ratio per experimentum confirmetur. Ante mortem autem illius apparuerunt multa signa oppilationis epatis et renarum eius cum color faciei dum febris erat remissa esset discoloratus et haberet difficultatem in anhelitu et lassitudinem corporis et pigritiam in motionibus et quandoque viderim egestionem partim chimosam et partim chilosam. Ideo fuerim certificatus videndo venam chilis quod erat opilatio in ea quemadmodum suspicabatur. Pulsus autem eius cum apparuerit valde diversus oppilationem in venis propinquis cordi maxime deservientibus pulmoni declarabat, iuxta exemplum Galieni 4° interiorum, de illo medico cuius pulsus diversitates omnium generum sensit qui postmodum periit sicut illi qui moriuntur ex cardiaca passione. Tua vero magnificentia testis est quod ille puer maximam diversitatem [fol. 18v] in pulsu habebat et ideo quemadmodum retuli semper magno dubio mihi fuit eo maxime quod medicamina oportuna non poterant exhiberi.

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[1] "Misinterio" is the actual reading of the rotograph, but I do not find such a word in the dictionaries.

Prima pars secundi corollarii videtur clara, licet enim vermes longi iuxta sententiam Avic. capitulo de speciebus vermium vermes longi sint generati ab humiditate super quam non dominantur divisio et separatio ex parte attractionis epatis et vehementie putrefactionis, et sint magis nocivi quam parvi et sint vehementioris fixionis, tamen non videtur verisimile per tot dies sumptis medicaminibus habentibus respectum ad vermes tum in educendo tum in interficiendo eos in duodeno remansissent. Secunda et pars patet ex sententia Domini Avic. capitulo primo de vermibus dicentis, et propter hoc causati sunt vermes et musce et que curso eorum currunt ex materiis putridis humidis quoniam illa materia cum rectificatur illud quod tollerant ut suscipiant de forma est animal vermiculare aut muscale, nam illud melius est quam ut ipse remaneant secundum putrefactionem puram. Ex quibus verbis videtur innuere dominus Avic. paucos vermes in intestinis repertos non esse nocivos cum ipso testante saliant vermes super putrefactiones et cibentur eis propter comunitatem et assummant eos a corpore. Et licet ita sit, tamen non assero, ut multi credunt, vermes in corpore, nostro esse bonos, cum etiam auctoritate principis non sit eorum dispositio faciens iuvamentum sine nocumento, cum ex vermibus generentur epilensia et fames canina et bolismus et putrefactio que est causa febris, immo, ut quidam retulerunt, vermes quandoque perforaverunt ventrem et exiverunt, ut testatur dominus Avic. allegato capitulo.

3m corollarium patet ex probatione ibi facta, febris enim erat sine frigore et tipo, licet in principio propter magnam elevationem vaporum ascendentium ad caput fuerit sompnus quasi subeticus cum aliquali extremorum infrigidatione dum scilicet materia movebatur quod forte accidebat, ut alias sepe vidi, ex retractione caloris ad intra nocumento percepto circa membra principalia. Et ideo febris erat continua habens exacerbationes proportionatas colere, et cum materia esset in partibus propinquis cordi, erat motus tremulus cordis ubi maxime manifestabatur frequens constrictio, que ut febris putridis [putridus?] magnam indigentiam emissionis vaporum ostendebat, nec erant accidentia causonidis cum propter etatem humidam et flegma multum impressio colere valde reprimetur. Nec inconvenit duas tertianas esse ad intra venas duobus cumulis [fol. 19r] in diversis venis existentibus diversimode motis ad putrefactionem, ut alias ego ostendi, forte enim materia que erat in vene chili ascendente putrescens faciebat tertianam maioris exacerbationis et illa que erat in vena chili descendente faciebat illam que erat minoris acerbationis. Sed hic magnum est dubium quomodo vena chilis ita magna maxime descendens esset tante oppilationis, non enim videtur posse illam venam oppilari nisi prius cetere vene epatis sint opilate maxima opilatione quod non potest esse stante vita. Et hoc est mihi potissimum argumentum ad credendum huiusmodi oppilationem ex dispositione principiorum naturalium fuisse contractam, bene tamen est verum quod forte materia admixta cum aquositate urinali que erat in vesica oppilationem faciebat in venis gibbi epatis et expulsa est a natura et deopilavit illas venas simul cum morte, et fuit crisis cathimica iuxta illud Galie. primo de creticis, due enim filii fuerunt cathimi qui invicem pugnantes se interfecerunt, ita forte natura expulit materiam et victa est ab ea. Sed magis existimo materiam facientem febrem retentam ut dixi in vena que vadit ad cor fuisse causam suffocationisillius quam aliquid aliud, cum neque in meseraicis neque in estate [epate?] apparuerit alique oppilatio sed solum ut dixi in vena chilis. Nisi dicatur quod materia in venis parvis epatis est ita parva que non potest sensu videri sicut illa que erat in vena chilis apparens grossa et viscosa adherens tunicis eius, et quod natura expulit subtile per urinam, grossum autem non potuit expellere et ideo accidit mors. Et in isto passu pendet tota vis huius inquisitionis. Et ideo Georgium ciprium aprime doctum supra hac re dum eris florentie consultabis etc.

4m corollarium sequitur ex premissis nam ex caliditate cordis et ebulitione illius sanguinis fuit genitum flegma salsum faciens mordicationem et ulcerationem sicut multis accidit quandoque circa gingivas ex flegmate salso descendente a capite. Quare autem cor suum fuerit magnum non existimo quod sit audacia a nativitate illi insita, potius enim timidus videbatur tempore sanitatis, sed erat multo sanguine repletum cor facientem ipsum [fol. 19v] turgidum et inflatum. Licet etiam forte naturaliter esset magni cordis quod in homine audaciam significat, licet in leporibus significet timiditatem, ut colligi potest ex dictis domini Avic. fen xi tertii capitulo primo.

5m corollarium notum est quia post duodecimum annum calor naturalis fit acutus virtutes omnes excitans maxime ad expellendas superfluitates et humiditas fit minor et ideo minus sunt apti tui filii post illud tempus talem incurrere egritudinem. Preservandi ergo sunt hac preservatione videlicet quolibet anno de mense aprilis debes dare diebus continuis hunc syrupum videlicet

R. Aque lupulorum
Fumiterre
Capilli veneris Omnium [Accipe] ʒ1.
Eupaterii
Bettonice

Misce pro duabus vicibus et qualibet vice ponatur ʒ1. acetosi simplicis et fiat potio et aromatizetur cum modico cinnamomi et detur de mane calida. Hanc tamen exhibitionem variandam duco iuxta annorum varietatem ut medici poterunt iudicare. Post huiusmodi syrup. sumant hanc medicinam. Recipe reubarbari electi ʒ1., infundatur in aqua lactis sumpti ex capris cum granis octo spice et aqua endivie et absinthii. Accipe [Omnium?] secundum partes equales cum granis octo spice, per noctem, deinde exprimatur et colatura detur vel cum cassia vel cum manna vel cum dyasena vel cum aliqua dosi trociscorum d'agarico secundum quod iudicatmedicus abstans. Et quia caput propter elevationem vaporum existimo esse in causa per accidens adminus cum elevati vapores ingrossati in capite post modum descendant per nervos et faciant mollificationem ut apparebat manifeste, ideo in ebdomada saltim quando vadunt dormitum darem eis unam vel duas pillulas ex aloe loto in aqua endivie, tamen et in hyeme aloes non lotus forte magis conferret.

Hec sunt breviter que videbantur esse danda, sepius tamen visitabo tuam magnificentiam et de reliquis potero certiorem reddere. Valeat magnificentia tua cui me summopere commendo.

Riccard. 930, fols. 17v–19v.

The following is a table of contents of the manuscript as a whole found on its flyleaf. I have added the references to the leaves where the various items begin.

Bernardi Tornii Florentini Opuscula Medica

1. De natura succus absynthii et an prosit in febribus quartanis.
2. Conclusiones circa materiam de febribus [fol. 8v].
3. Propositiones quaedam de mala complexione diversa et equali [fol. 14v].
4. Arbor de qualitatibus ac deinde de calido [fol. 16r].
5. Relatio anatomica [fol. 17v—our treatise].
6. Epistola super quibusdam dubiis circa motum [fol. 20r].
7. Epistola ad Magistrum Franciscum Ninum super quandam quaestionem de Phlebotomia et Pharmacia [fol. 23r].
8. Quaestio de reduplicatione corporum [fol. 26r].
9. Dissertatio super conclusione[m] Nulla sanitas semper est sanitas simpliciter, ad magistrum Franciscum Senensem [fol. 31v].
10. Responsiones ad argumenta eiusdem Francisci contra eandem Dissertationem [fol. 34v].
11. Definitiones corporum recollecte ex verbis Plusquam Comentatoris, anno 1485 [fol. 38v].

TRANSLATION

Worshipful judge, I grieve over thy sad lot, for to lose one's offspring is hard, harder to lose a son, and hardest by a disease not yet fully understood by doctors. But for the sake of the other children I think that to have seen his internal organs will be of the greatest utility. Now therefore I will not hesitate to state as briefly as I can what we have seen and draw my honest conclusion and adduce the remedies which in my judgment are advantageous.

In the first place the belly appeared quite swollen, although the abdomen was thin. But after dividing according to rule mirach [the abdomen] and sifach [the peritoneum] we saw the intestines and the bladder which was full of turgid urine. Removing further the colon and caecum, there appeared in them more gross wind than filth. Then when the ileum and jejunum and duodenum were removed, two worms were found, quite large and white, showing phlegm rather than any other humor. After the intestines had been cut off from the mesentery, since nothing notable was found therein, seeing that the bladder was turgid, I had it cut open and a great quantity of urine appeared, although before he died, as they reported, he had discharged a large amount of urine. Afterwards we examined the liver which was marked with certain spots like ulcers and somewhat swollen about the beginning of the

chilic [i.e. portal] vein. But what is more remarkable, there appeared around the source of the emulgent veins in the hollow of the chilic vein an evident oppilation [stoppage] by which the whole cavity was filled with viscous humor for the space of the thickness of a finger, beyond which humor no blood was seen beneath, while the emulgent veins were full of blood, quite watery in character, and the swollen veins were full of this sort of blood, or perhaps of much urinal wateriness admixed with it. Moreover, the ascending chilic [i.e. vena cava] had the branch to the heart filled with much blood and the heart was much swollen, and so the auricles too appeared swollen beyond measure. When these were cut open, a great part of the blood came out, and so almost all the blood was found near the heart. But the vein which carries the nourishing blood to the lungs was also full of similarly viscous humour and seemed wholly free from blood. Having seen this much I did not examine further concerning anything else, since the cause of his death was apparent in my judgment. . . .

From these facts I infer first that this lad had contracted a great oppilation [i.e. obstruction] either from birth or in the course of time, and it is safe to assume that matter of this sort was accumulated by gradual congestion rather than brought by a deflux from another member.

Secondly I infer that those worms were generated after the beginning of his principal illness and were in no way the cause of his death.

Third I infer that when transmission of blood through the chilic vein and the pulmonary vein was prevented, ebulition and fever resulted. And because in that blood there was much phlegm, that fever was assimilated to phlegmatic in many accidents, though from the manner of its oncoming and development there seemed to be two tertians. For every third day it came on worse in the night, as those present reported and I infer clearly from his restlessness and perceived from his pulse.

I infer fourth that those spots of the liver were generated after the oppilation.

Fifth and last I infer that any son of yours of the same constitution is to be preserved to his twelfth year with the usual medicines which I will mention in closing.

The first corollary quickly follows from what I saw with my own eyes. For Galen remarks in the sixth book of his Therapeutic, first those matters which require consideration should be considered, and then certified by experience so that reasoning may be confirmed by experiment. Moreover, before his death there appeared many signs of obstruction of the liver and kidneys, the hue of his face while the fever slackened was discolored, he had difficulty in breathing and lassitude of the body, slowness in his motions, and sometimes I had seen egestion partly chimosic and partly chilosic. So I was assured on seeing the chilic vein that that there was obstruction in it as I had suspected. Moreover, his pulse, since it appeared to vary greatly, indicated obstruction in the veins adjoining the heart, especially those serving the lungs, according to the example in Galen's fourth book of internal members of the physician whose pulse showed all sorts of diversities, who afterwards died just the way those who die of cardiac complaint die. But your Worship is witness that that lad had the greatest diversity of pulse and to such a degree, as I reported, that I was always in much perplexity because I could not administer the requisite medicines.

The first part of the second corollary seems clear, for while long worms according to the opinion of Avicenna in the chapter "De speciebus vermium" are generated from humidity, over which division and separation do not prevail apart from the attraction of the liver and the force of putrefaction, and are more harmful than small worms and harder to get rid of, yet it does not seem likely that they would have remained in the duodenum for so many days while medicines were being taken which are good against worms both to expel and to kill them. And the second part of the corollary is manifest from the opinion of lord Avicenna, first chapter concerning worms, where he says, "And on this account are produced worms and flies and crawling things from humid putrid substances, since that which is taken away from first matter in order to receive form, when it is rectified becomes a worm-like or fly-like animal, for this is better than that it should remain pure putrefaction."[1] By which words lord Avicenna seems to suggest that a few worms found in the intestines are not harmful, since as he says the worms spring from putrefactions and feed on them because of their homogeneity and take them from the body. While that may be the case, yet I do not assert that, as many believe, worms in our body are a good thing, since again from the authority of the prince of medicine it is not their nature to help without harm, since from worms are generated epilepsy and canine hunger and *bolismus* and putrefaction which is the cause of fever. Nay more, as some have reported, worms sometimes have bored holes in the belly and come out, as lord Avicenna testifies in the aforesaid chapter.

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[1] The reference is of course to the then accepted belief that worms, flies and other insects were spontaneously generated from filth and putrefaction.

The third corollary is patent from the proof there given, for the fever was without burning and chill, although at the beginning because of a great rising of ascending vapors to the head, sleep was produced as if in hectic fever with some coldness of the extremities while the [diseased] matter was moved about, which perhaps happened, as I have often observed in other cases, from withdrawal of heat to the inner parts when injury is felt about the principal members. Moreover, the fever was continuous, having proportionate exacerbations of cholera and, since the [diseased] matter was in the parts near the heart, there was a tremulous movement of the heart where especially was manifested frequent constriction which like putrid fever revealed a great lack of the emission of vapors, nor were the accidents of *causodes*,[1] since on account of his humid age and the abundance of phlegm the impression of cholera was strongly repressed. Nor does it matter that there were two tertians within the veins with two accumulations in different veins variously moved to putrefaction, as I have shown in other cases, for very likely the matter which was putrefying in the ascending chilic vein [i.e. the vena cava] made a tertian of greater exacerbation. But this is a matter of grave doubt, how the chilic vein which is so large, especially the descending one, could be so stopped up, for it does not seem that that vein could be clogged unless first the other veins of the liver were clogged with the greatest oppilation, which cannot happen while life lasts. And this is the strongest argument to me for believing that oppilation of this sort was contracted from the disposition of natural principles [i.e. from a fundamental disposition of nature]. Nevertheless it is quite true that the matter which was mixed up with urinal aquosity in the bladder may have produced oppilation in the veins of the hump of the liver and been expelled by nature and filled those veins with watery fluid simultaneously with death and produced a cathimic crisis according to that saying of Galen's in the first book on critical days. "Two sons were gladiators who fighting together killed each other": so nature may have expelled the matter and have been overcome by the effort. But I am more inclined to think that the matter producing the fever, retained, as I have said, in the vein which leads to the heart, was the cause of that suffocation than was anything else, since neither in the meseraic [veins] nor in the liver was any oppilation apparent but only, as I have said, in the chilic vein. Unless it is held that the matter in the small veins of the liver is so small that it cannot be seen as can that which was in the chilic vein gross and viscous in appearance and adhering to its linings, and that nature expelled the subtle [matter] through the urine but could not expel the gross and so death resulted. And on that point hangs the whole force of this investigation. So while you are in Florence you will consult on this point Georgius Ciprius [George of Cyprus?] an exceedingly learned man.

The fourth corollary follows from what has gone before, for from the heat of the heart and the ebullition of that blood was generated salt phlegm causing mordication [necrosis] and ulceration, as happens to many about the gums from salt phlegm descending from the head. As to why his heart was large, I don't think it came from audacity inborn in him, for he seemed timid rather when he was in good health, but the heart was filled with a great quantity of blood which made it turgid and inflated, but it may be he naturally had a large heart which in man is a sign of audacity though in hares it signifies timidity, as may be learned from the statement of lord Avicenna, eleventh Fen of the third part, first chapter.

The fifth corollary is known [or noted] because after the twelfth year the natural heat becomes acute, exciting all the virtues strongly to expel superfluities, and humidity is lessened, and hence your sons are less liable after that age to incur such a disease. Therefore they are to be preserved by this preservative, that is, each year in April you ought to administer daily the following syrup:

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[1] A particular variety of fever.

Water of Hops
Fumitory
[A dram each of] Maidenhair
Agrimony
Betony

Mix twice and each time use one dram of pure vinegar and make a potion and spice it with a little cinnamon and give it hot in the morning. But I think that this prescription should be varied according to their years, as the doctors may judge. After this syrup let them take this medicine: of choice rhubarb take one dram and pour it into water of milk taken from goats with eight grains of spice [?] and water of endive and wormwood. Take it in equal parts with the eight grains of spice [?] through the night. Then let it be pressed out and give it as a blood-cleanser with cassia or with manna or with dyasena or with a dose of trochees of agaric as the doctor in charge judges best. And as I think that the head because of the rising of vapors is one cause of trouble, at least to the extent that when heavy vapors rise in the head beyond measure they descend through the nerves and produce softening, as appears manifestly, therefore at least once a week when they go to bed I would give them one or two pills of aloes soaked in water of endive, but in winter aloes not soaked might be better. These are briefly what it seems should be prescribed, but I will visit your Worship often and shall be able to learn more concerning the other children. Farewell, your Worship, to whom I commend myself with all my heart.

THEODORE BILLROTH, SCHOLAR, MUSICIAN, MASTER SURGEON *

By E. ROBERT WIESE, M.D.

PITTSBURGH

IN the dark and troublesome days of the reconstruction of Europe, following the downfall of Napoleon, Ruegen became a German possession and in 1815, Prussia finally succeeded in gaining control of entire Pomerania. Lying in the Baltic Sea close to the continental coast, betraying in the character of its inhabitants the vicissitudes of its history, the island seemed of little or no consequence at the time. To the medical historian, indeed to all medical men of today it is of great significance, for in Bergen, the capital and principal city of the island, was born April twenty-sixth, 1829, Christian Albert Theodore Billroth, scholar, musician, and master surgeon.

Of his ancestry we know little beyond what is found in a brief autobiography. The Billroths were originally of Swedish stock. As a young man of twenty-eight years, the Rev. Carl Theodore Billroth, Theodore's father, came to Bergen to serve as assistant to the aged Rev. Knust. He married Johanne Christiane Nagel, of Berlin, in whose veins French blood flowed. Billroth remembered little of his father; his mother, evidently a woman of keen insight, decided opinions and deep sympathies, greatly influenced the course of her son's early life. In 1832 the family moved to Rheinsberg, where the father served as minister until pulmonary tuberculosis caused his death in 1834. He was survived by his widow and five sons.

Alone with five children, Theodore, the eldest, barely five years of age, with not any too many of this world's riches, the outlook must have seemed anything but cheerful to the young and delicate mother. In order to be among relatives and friends she went to Greifswald where the children attended school. At no time during his early school life did Theodore display any brilliancy in his studies. Indeed it seems that the services of a tutor were often necessary to get him over the rough places. One of these tutors in memoirs written after Billroth's death describes his former pupil as a "tardum ingenium," of slow comprehension and stumbling speech. Language and mathematics appear to have been especially difficult for him to master. Among his school mates in the Gymnasium were several whose names became prominent in later years, i.e. Bernard and Max Schultze and Hugo Ziemssen.

That Billroth studied medicine at all seems to have been largely the result of family interference. He developed musical talent quite early in life, and had it not been for the decided opposition of his mother, would have taken up that study after completing the Gymnasium. Two of the Professors of the University Medical Faculty, Seifert and Baum, were close friends of the Billroth family, and the young man enrolled as a student of medicine in the University of Greifswald in 1848. Even then he seems to have paid little or no attention to his scientific studies as he devoted practically the whole of the first semester to music. At the beginning of the Easter semester, Baum answered a call to the University of Goettingen and Billroth followed him, but it was a transformed Billroth. While at Greifswald he was indolent, indifferent and apparently not interested in his studies, he was quite the reverse at Goettingen. The character of the faculty of the University may have had something to do with the change.

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* From the Dept. of Surgery, Washington University School of Medicine, St. Louis, Mo.

Here were Woehler, Wagner, Martin Langenbeck, Frey, Bergmann, Leuckart, Lotze, Fuchs, Baum, Wilhelm Weber and Ruete, men of such contemporaneous importance, that were they living today, no Minerva would be complete without their names. Billroth was not unresponsive to their influence and example. Two of these especially shaped his destiny, for under the genial instruction of Wagner he soon became immersed in microscopic studies, while thanks to the almost paternal interest of Baum, the scientific and practical applications of surgery were revealed to him in a way hitherto undreamed of. However music was not abandoned, for while in Goettingen, Billroth found inspiration and expression in the home of Arnold Wehrer, the director of music. A remarkable friendship between Billroth and Meissner was also formed and cemented by their mutual love of music and science. Both were engaged in special studies in physiology and were invited by Wagner in the fall of 1851 to accompany him to Trieste where they investigated, histologically, the beginnings and endings of the nerve fibres in the electric ray. They then visited the Universities of Giessen, Marburg, Heidelberg and Vienna. It was this young man's first long journey and the impressions made upon him by the beauty of the Mediterranean and the grandeur of the Alps were lasting and pleasant. The trip, however, was interrupted by the death of Billroth's mother, who died of pulmonary tuberculosis. Owing to the paucity of her estate, further study would have been impossible had it not been for the generosity of his grandmother. In the later end of the same year (1851), he left Goettingen to continue his studies in Berlin where von Langenbeck, Schoenlein, Romberg and Traube were making medical history. Traube led him into the paths of experimental pathology and probably was responsible for the subject of Billroth's inaugural dissertation "De Natura et Causa Pulmonum Affectionis, quae Nervo Utroque Vago Dissecto Exoritur," when he graduated in 1852. After completing his military duties and having passed the required State examinations Billroth worked in the private clinic of Albrecht von Graefe, who was just beginning his meteoric career.

In the spring of the next year (1853), he again visited Vienna where Oppolzer's Clinic and the courses given by Hebra and by Herchl were especially appreciated. The homeward journey was arranged to lead through Paris enabling him to meet Baum and Meissner there. After a stay of several weeks in Paris, Billroth returned to Berlin to enter general practice. Two long and weary months passed without a single patient when chance led him to visit his friend and countryman, Dr. C. Fock, who had lately been assistant in the Langenbeck Clinic. Acting upon the advice of Fock, but really with but small hope of success, Billroth applied for a vacancy in the Langenbeck Clinic and was fortunate enough to obtain the appointment. Thus, one might almost say, Billroth became a surgeon by accident.

The very atmosphere of his new environment was charged with enthusiasm and the spirit of research. Here he became acquainted with Meckel, von Hemsbach, von Graefe, Wilms and von Baerensprung. He soon discovered, however, that to become a surgeon required more years and greater application than he thought he could devote to the subject and turned his attention to pathological histology, a science then only in its beginning. The large clinical material at his command, combined with almost indefatigable energy, quickly gave him that foundation in pathology that enabled him in after years to speak as one with authority. During the three years he was engaged in this work he published 14 papers, all valuable in their day but now mostly of historic interest. A few months after becoming "Privat Docent" (1856), Billroth gave his first course of lectures on pathological anatomy, to be followed shortly thereafter by courses in general and special surgery, as well as work in operative technique. All were great successes, they became very well known and were repeatedly given in successive years. A trip through Holland, England and Scotland, which claimed the Fall of the same year (1856), broadened his views and was of great benefit. During the following year Billroth applied for the position of surgeon to three different hospitals, among them Danzig, and was unsuccessful in every instance, certainly not a very encouraging prospect. Notwithstanding these rebuffs, however, he apparently had determined to abandon the teaching of pathology and become a surgeon, for a call from the University of Greifswald, in 1858, to serve as professor of pathological anatomy was declined. On the twentieth day of August, of that same year (1858), Billroth and Christel Michaelis, the daughter of the former court physician, were married in Thueringen. Let it be said in passing, that the marriage was a very happy one and perhaps no little of his success may be attributed to Frau Billroth's ability to understand and to appreciate the genius of her husband and to keep from him the petty cares that often destroy the charm of a home. The esteem with which von Langenbeck regarded his young assistant may be judged by the fact that contrary to almost universal custom Billroth was retained as assistant while living outside the Clinic. His letters, however, give the impression that in spite of von Langenbeck's kindness and patronage he was much discouraged at this time and the call from the University of Zurich to occupy the chair of surgery was eagerly accepted. Billroth had despaired of getting the appointment and the letter, fastened by his wife to the Christmas tree, was regarded as a veritable Godsend.

On April first, 1860, Billroth assumed the duties of professor of surgery in the University of Zurich and a new chapter began in his life. A more congenial spot could scarcely have been selected. The faculty of that famed institution at that time included such men as Griessinger, Biermer, Moleschott, Fick, Frey, Horner, H. Meyer, Rindfleisch, Breslau, and Eberth, all masters of their time and generation. Zurich had none of that hurry and activity so characteristic of the von Langenbeck Clinic. Here Billroth had time to reflect and to consider, as well as to formulate and carry out his own ideas. Visitors from other universities were numerous and during the seven and a half years he spent in this mountain town his circle of friends widened to include almost every medical man of note in the Swiss, the German and the Austrian Universities. Luecke, Munk, Klebs, Schiff, Door, His, Stein, O. Weber, Volkmann, Esmarck, Simon were not only found in his Clinic but were just as frequently visitors in Billroth's home. A year after his establishment in Switzerland the chair of surgery was offered him by the University of Rostock and was refused. No better fate met a like call from the University of Heidelberg in 1864. Every evidence of rejoicing, including a torch light procession, was given by the students as an outburst of their appreciation of his determination to remain with them. These were happy, but not unclouded years for it was in Zurich that Billroth buried his only son, who died of scarlet fever. In adversity as in prosperity men reveal themselves. While we lack any letter concerning the death of his son still we may rest assured that Billroth was not found wanting in his hour of trial.

At that time medical splendor centered about three cities, Paris, Berlin and Vienna. Vienna, if not first, certainly ranked second in importance. When therefore, in 1867 the call came from Vienna to fill the chair of the lamented Shuh, the temptation was too strong to resist. He accepted, only after deliberation, for pulmonary tuberculosis loomed like a grim spectre, in both his wife's and his own family history. From a sanitary standpoint Vienna, at that time, was anything but a model city and Billroth had a wife and three daughters to take into consideration. Ambition however outweighed apprehension and Billroth delivered his first lecture in Vienna, August twentieth, 1867, thereby beginning the work that has placed his name among the master surgeons. For years he had to contend with opposition, all the more bitter because not outspoken. To one acquainted only with the Viennese gayety, frivolity and "gemuetlichkeit" their clannishness is incomprehensible. Their loyalty to a native son is remarkable and Billroth although an Austrian subject was a native of Prussia. For a long time, except for the patients from the clinic or from the wards, few, if any of the better class, came to him even though patients from Paris, Berlin, Constantinople, London, New York and Chicago visited Vienna only because Billroth was there. The students at first were shy, due largely to the fact that he did not teach surgery as though it were a complete science, but on the contrary, seemed constantly to emphasize the fact that while there were certain principles, well known and established, there was yet much that was indefinite and unknown. The conception that his clinic and his lectures were not for beginners became rumored abroad. There was also an occasional lack of congeniality in his relations with the members of the faculty. Born a North German, energetic, and naturally ambitious, he met many a rebuff in the suave, easy-going, happy-go-lucky, one might almost say superficial, way in which the "Wiener Kinder" managed the University affairs.

His friends were not confined to the medical profession for Billroth was above all broad-minded and well educated. His circle of acquaintances was extensive including members of all trades and professions. Among his intimates in Vienna were Brahms and Haenslich. Two years after settling in Vienna, a call from the Charité in Berlin to take the chair of surgery received no consideration and by the time a similar request had come from the University of Strassburg, in 1872, Billroth had become so firmly attached to Vienna and he had by his geniality and diplomacy so overcome the many obstacles, that he felt Vienna was his home and he declined the honor. In 1882 von Langenbeck retired from active service and Germany offered him the greatest surgical position in the empire but in vain. He was by this time one of the Viennese. The first few years in Vienna had been anything but pleasant, however, and nothing but the determination of a strong-willed man enabled him to see it through. It was during these years, also, that the fears that had made him hesitate before coming to Vienna were discovered to have been well founded as the second of his three daughters died of what was probably pulmonary tuberculosis. Work, hard intense work has ever been the safety valve of men of strong character, and the dogged persistence with which Billroth attacked the problems of the Clinic in those beginning years may have been activated, at least in part, by the desire to be kept from indulging too freely in oppressive thoughts and misgivings. The fruit of that intensive work placed him high in medical history. In 1870 the war aroused in him the desire to serve his native land and by special dispensation, for Billroth was no longer a German subject, he gained the experiences in the Army Hospitals at Mannheim and Wessenburg that enabled him to write those letters that are interesting even today. Slowly, very slowly, the kindliness of his nature overcame the prejudices that greeted him upon his arrival, distrust and inappreciation gradually gave way to confidence and respect and when, in the spring of 1887, Billroth was stricken with pneumonia, Vienna was a saddened city. Rich and poor, high and low were alike interested. News of his condition was awaited by the people as though he were one of their own family. This was the turning point, for although he apparently improved greatly under proper treatment and on his sixtieth birthday appeared hale and hearty, attacks of circulatory disturbances recurred at shorter and shorter intervals until in 1892 at the celebration of his twenty-fifth anniversary, as teacher in the University of Vienna, Billroth was a broken man. The sufferings incidental to a progressive myocarditis were borne with a patience and a fortitude that at once aroused the admiration and the sympathy of all who remembered the energy and the activity of his former years. In December, 1893, he went to Italy to regain his health, whence he writes to Woelfler that he asks but two more short years. He prays also that there be "nur kein laengeres Siechtum." His prayer was answered only in part. He died at Abbazia, February sixth, 1894.

The Imperial City on the Danube has buried within its walls the mortal remains of Maria Therese, Maximillian, L'Aiglon, Franz Joseph and many other lights of history, but seldom has Vienna seen a more impressive funeral than that of Billroth. This onetime stranger had so won the affections of his fellow-citizens during his twenty-seven years stay with them that they had come to look upon him as one of their own and while, perhaps, they could not at all times understand him, they had learned to appreciate him, to respect him and to love him. It was one of those few occasions in history when mankind mourned its loss, not with the pomp and the splendor and the ostentation accorded to one of its destroyers, but with the depth of feeling, the sincerity and the honors befitting one of its saviors.

Such in brief is the life story of Albert Christian Theodore Billroth.

FRIENDS, MUSIC, HOME, HOME LIFE

Billroth was one of those peculiarly gifted individuals who not only readily make friends but keep them. Naturally those speaking his own language were closest to him. He seemed to endow them with the virtues he preferred them to have and then loved them as though they really possessed those good qualities. No one ever heard him speak harshly of a friend; he constantly emphasized the better side of human nature and at no time would he permit any belittlement of an absent person without championing the cause of the one not present. One of the foremost, if not the foremost surgeon of his day, one would expect that his intimates would be exclusively medical men but such was not the case. The world famous Brahms, whom he somewhat resembled, and the well known Haenslich, both musicians, were thus favored. When Berlin, in 1882, sent him the call to take the chair of the great Lagenbeck, Billroth refused and one of the reasons whimsically, yet truthfully, given to those nearest to him was that he could induce neither Brahms nor Haenslich to go with him. His home while in Switzerland and more so while in Vienna was always the gathering place of a gay and happy, yet learned, company. In Alserstrasse and later, during the summer months, in St. Gilgen on the Wolfgang See, many of Brahms best known songs and chamber music were played for the first time. Billroth's eldest daughter possessed a voice of rare beauty and often delighted these gatherings with the best of real music. With Billroth music was a passion and it may truthfully be said that had he not been such a surpassing surgeon he would have been a famous musician. While a Gymnasium student he went to Berlin during the summer months to study piano under Kullak. During his student days in Goettingen, Jenny Lind visited the place and Billroth's letter to his mother descriptive of the concert and of his meeting her afterward, is one of the most ingenuous, naive, genuine outbursts of youthful enthusiasm to be found in literature. In Switzerland he took up the study of the viola with such success that shortly thereafter one evening a week was "Trio Abend," and Schumann was an especial favorite. During this period he also wrote numerous musical reviews and criticisms for the *Neue Zurichsche Zeitung*. Even at the time of his death he was interested in the collection of material for his book "Wer ist Musikalisch?" a psycho-anatomic-physiological study of the sense of beauty and rhythm. As a composer he did not take himself too seriously and usually burned much that he wrote.

His happy family life was marred by the death of his only son and the second of his then living daughters. A fourth daughter was born shortly afterward and the immediate family remained confined to three daughters, his wife and himself. In due course of time the two elder daughters married and two grandchildren played about and cheered the declining years of the great surgeon. When in health nothing had pleased him more than to have about him his friends and companions. He entertained lavishly and freely but when disease put its hand upon him he put his house in order, gave up his fine home and lived quite simply until the end.

That a man of so many activities and such a variety of tastes and inclinations could find time to read, study and write often puzzled his friends and coworkers. Billroth, whether by training or by natural ability could take up a subject at any time and so concentrate upon it as to give it all of his attention. His ability to relax was just as great. Thus after a strenuous day in the lecture hall, the ward, the operating room, the laboratory, Billroth would rest at the opera, the concert, or at his home entertaining his friends. Then after the relaxation of the evening he would concentrate upon his books or his papers. He required little sleep, indeed it is probable that he was a victim of insomnia. He was an omnivorous reader and also spent a great deal of time keeping up his correspondence.

THE MAN AND HIS WORK, SCIENTIFIC AND OTHERWISE

Billroth has been described as a man with twinkling blue eyes, of more than average height who walked with a slight stoop, his head bent forward in a pensive manner. Nothing ever disturbed his temper and the most unforeseen happenings in the operating room, the ward, the clinic, were met with an equanimity that apparently nothing could shake. A fluent delivery, a wonderful selection of words, freedom from all preconceived ideas, a thorough and fundamental comprehension of his subject made him one of the greatest teachers, not only of his time, but of all time. Combined with a wonderful didactic talent was the ability to draw and he never hesitated to appeal to both ear and eye. Endowed with indefatigable energy he inspired all about him to do their utmost. Himself young when he came to Vienna, he readily understood the students, took part in their festivals and quickly broke down their prejudices. In the clinic Billroth always had his own ideas and followed them. A pathologist of no mean repute, his conception of surgery was quickly evidenced upon his arrival in Vienna by the appointment of Czerny, a pathologist, as first assistant. His new views, his explanation of all symptoms on the basis of pathology, his spirit of investigation fired his assistants and aroused their ambitions. There was little or no jealously among them. Billroth usually assigned to each some problem to solve, but beyond giving advice or offering suggestions when asked, did little to influence the assistant's work. The completed "arbeit" was carefully checked and Billroth always took care that the article should appear in some reputable journal. In case any of his assistants made application for position elsewhere, he would use his influence, and frequently only after many years would the fact that such influence had been exercised become known. One by one those assistants took their place in the surgical world and each left his mark: Czerny, Mikulicz, Gussenbauer, Woelfler, Hacker, von Eiselsberg, Winiwarter, Fraenkel, Kocher. Men's deeds live after them and while these assistants no longer sway the trend of surgery, the assistants of those assistants teach today and Billroth is yet with us.

Early in his career Billroth was reputed to be a daring operator. It was then that he operated for example upon almost every case of carcinoma because at the time little, if anything, was known of surgical prognosis.

As experience, observation and study of the cases brought understanding and knowledge, distinction was made. The modern follow-up system was originated and in the course of years contraindications, as well as indications, for operation were established. It was then, in his later years, that complications were recognized before operation, and Billroth became known as a careful, conservative surgeon. Two things are certain: because of early intervention, many cases were saved by this indiscriminate operating that otherwise would have become inoperable: and a marvelous technic as well as a knowledge of disease processes was gained and profited by in later years.

The Vienna Clinic became a surgical Mecca. The method of teaching was unique for that day. The cases were shown, the history and the reasons for operation were freely discussed from every angle. Never was the viewpoint of the patient ignored. As an operator Billroth was quiet, swift and sure. He usually lectured during the operation. The work, as a rule, was begun as though the case were typical and the regular textbook operation were contemplated but the operation was always altered to suit the individual case. The postoperative course of the cases was made known from time to time by announcements and by regular ward rounds. At no time was there any posing or resort to sensational practices. Seldom has a teacher or a chief been loved, honored and respected, by patient and pupil, as was Billroth.

Although a natural delicacy, as well as established custom, frowns upon the reading of private correspondence, letters of Billroth edited and published with the permission of his survivors, certainly lose most of their sanctity, without minimizing their value. Nowhere is Billroth revealed more clearly than in the letters edited by Fischer. In them we read the gamut of human feeling expressed by a man of culture and refinement, of broad interests and keen insight. They tell of contemporaneous events in the medical world, of this man's appointment and that man's achievements, they relate to us the everyday occurrences, his hopes and ambitions, his disappointments and his discouragements; they make us acquainted with his friends: His, Baum, Kocher, von Eiselsberg, Brahms, Haenslich; they bring to us the operas and the music he heard, they color the trips he took and in them we rejoice in the honors he received. To be appreciated they must be read not only in the language in which they were written, but also in the spirit in which they were composed.

Time and space alike permit mention only of the most important of his scientific works. His studies on the development of the blood vessels and on the comparative histology of the spleen, his monograph on the structure of mucous polyps, his work on the cysts of the testicle, on fibroid tumors of the superior maxilla, on tumors of the parotid gland, on tumors of the mammary gland and his lectures on operative technique and pathologic anatomy, published while in the Langenbeck Clinic, procured his call to Zurich as professor of surgery. Articles on resections of bones, on the microscopic structure of pathological lymph glands, on the origin of fibroid tumors, on the growth of normal bone, to say nothing of the monographs on the diseases of the breast and on burns, lacerations and infected wounds which appeared in the "Handbuch der Chirurgie," edited by von Pitha and himself bear witness to his industry while in that city. However these are of comparative insignificance in contrast to his first great work "General Surgical Pathology and Therapeutics" which appeared in 1863. The finish and perfection of its style concealed the difficulties attending its composition. It presented in a most attractive and fluent manner what was then one of the dryest and least studied of subjects. The new ideas which illuminated the work made it most popular and eight editions appeared during Billroth's life. French, English, Russian, Italian, Spanish, Hungarian, Polish, Servian, Croatian and

Japanese translations have been made necessary. Its publication made him known in the scientific world as a writer, investigator and teacher, and was largely responsible for his call to Vienna.

Apparently he wasted no time after his arrival in the Austrian capital, for in 1868 the monograph on "Scrofula and Tuberculosis" was published in the "Handbuch." A year later another master work "The Surgical Clinic of Zurich, 1860 to 1867" created a furor. This with its companion volumes "The Surgical Clinic of Vienna, 1868 to 1869, and 1870 to 1876" published in 1879, are unique in medical literature. They constitute the first unprejudiced review of the work that had been done in those institutions. It is the beginning of the era of statistics in surgery. The amount of labor involved was colossal, the numerous histories reviewed, the follow-up letters written, the tabulation and the correlation of facts formed a gigantic undertaking. Bad results, good results are all one, blame and praise are distributed where deserved, success and failure are alike disclosed. "Wahrheit und Klarheit" was his motto and seldom has anyone adhered more closely to it. In the interval between these two volumes, however, much of interest made its appearance. A review of neoplastic diseases in 1869 was followed shortly afterward by a series of letters relating his experiences in the Lazaretts in Mannheim and Weissenberg during the Franco-Prussian War. The operation of resection of the esophagus, in 1871, was undertaken only after careful study on the cadaver and long experiment upon living animals. The same care, the same strict attention to minor details, the same, almost painful preoperative preparations marked the successful extirpation of an extensive carcinoma of the tongue in 1873. An international meeting of the delegates of the Red Cross Society in Vienna that same year inspired "A Historical and Critical Study of the Transportation of the Sick and Wounded to Railway Trains," a book noteworthy in its day and generation but now almost forgotten. However, his "Medical Sciences in the German Universities" had a different fate, it appeared in 1879 and only recently, was still deemed worthy of a translation by the Nestor of American physicians, William Welch. It is a work of enduring worth, suggestive and stimulating even today, and displays a depth of knowledge, with a breadth of vision that only great experience and profound thought could have made possible. Five years later (January twenty-ninth, 1881), modern abdominal surgery was born when Billroth performed what is now known as Billroth's resection of the stomach for an extensive carcinoma of the stomach. There was nothing accidental in its success. Months of hard, persistent study preceded the attempt, the pathology of gastric carcinoma was thoroughly reviewed, statistics were scrutinized from every angle and an entirely new technic had to be devised and practiced. His next great work concerned not only the medical profession but the public as well. A few years after the meeting of the Red Cross Society in Vienna he had joined, half against his will, a society formed by the exigencies of the war of 1866. It had for its object not only the building of a hospital, but the founding of a training school for nurses as well. The worthiness of its ambition quickly enlisted his sympathy and his energy.

Austria had been accustomed to entrust all the responsibilities of nursing to the nuns, and that any woman other than a "Sister" would take up the profession, was simply unheard of in that day. The fact that Billroth, one of the chief advocates of the new project, was not of the Catholic faith could not be forgotten. Little by little, however, prejudices were overcome, one by one the difficulties were conquered or circumvented until the historic Rudolfinerhaus became a reality. Not the least of the means employed in materializing a dream and moulding public opinion was Billroth's book "The Care of the Sick in the Home and in the Hospital." Written in a manner comprehensible by the layman, it yet imparted enough scientific information to serve as a textbook for nurses.

Today one of the places intimately associated with the medical profession of Vienna is the home of the Royal and Imperial Society of Physicians. For years Billroth planned, worked and pleaded with the members of his profession, but not until 1893 did he succeed in the almost impossible task of persuading physicians to unite in an undertaking beneficial to themselves. The formal opening of the building, late in October, 1893, marked the triumph of his patience and labor.

Like most surgeons of active and normal imagination, Billroth entertained plans for a new surgical building to be built according to his own ideas and requirements. Promises that he should realize the hope were repeatedly given but never fulfilled, and Billroth died without the materialization of the clinic in the court of the Allgemeines.

Today it is apparently difficult to realize that any opposition should have been aroused by the introduction of the practice and theory of antisepsis. Let it not be forgotten, however, that in the case of Billroth, the subject of infection and its treatment was not new. As early as 1861 he had published observations on the subject of "Wound Fever and the Accidental Diseases of Wounds," to be followed three years later by a second series of observations largely corroborative of the first. His labors in the field never ceased and by the time Lister's paper appeared in 1867 he had devised, after many years of experimentation, a fairly successful method of open treatment of wounds. To him the theory of Lister did not seem free of scientific objections. The amount of energy and thought expended in the preparation of his book in 1874 on "Cocco-Bacteria septica" is almost incredible. Night after night he spent at the microscope and Billroth worked with a zeal approaching frenzy sixteen to eighteen hours a day for months at a time. Blinded by the belief that there was only one species, coccus, in the group of Schizomyetes and that under different circumstances this species not only could, but would assume the shape of coccus or bacterium, he failed to grasp the great truth in bacteriology and did not comprehend the importance of the rôle those microorganisms play in infection. That he did not impetuously abandon all the results of his labors and his researches is not surprising. Rather more surprising is the fact, that he did send his assistant to Edinburgh to learn the method at first hand, and that he was not indifferent to the enthusiasm of such men as Volkmann, Thiersch and Nussbaum, and that Woelfler, upon his return from Scotland, was permitted to prove the new method in a ward of his own, speaks volumes for Billroth's sense of fairness and thirst for truth. Adherence to one's convictions, in the absence of sufficient evidence to the contrary, is not a fault; courage sufficient to acknowledge error and to join the ranks of the former opposition requires magnanimity and deserves commendation. While Billroth became a follower of the Lister doctrine with reservations, let it not be forgotten that today few, if any, follow the doctrine of antisepsis as Lister taught it. If we judge him we must do so because of his reluctance to accept a method of whose truth he was sceptical. Let us judge him not by the standards of modern ultra science, but rather by those of his day and age. Let us remember him for his faithful love of, and tireless search for truth, for his magnificent contributions to the relief and alleviation of human suffering, for the influence he exercised and still exercises upon his pupils and the pupils of his pupils.

"He was an artist and who shall arise to stand beside him?"

MICHAEL SERVETUS, PHYSICIAN AND HERETIC*

By GEORGE A. WILLIAMS, M.D.

ATLANTA, GA.

MICHAEL Servetus, through the vagaries of fortune known also as Michel Villeneuve, Michael Villanovanus, and as he once styled himself, alias Revés, was born at Villaneuva in the province of Aragon, Spain. The year of his birth is uncertain, being given by Servetus himself on occasions as both 1509 and 1511, but suffice it to say that the tremendous force of the Renaissance had already begun to stir the thought of man, long stagnant in the worship of ancient masters. At the trial in Geneva he described his parents as being of an ancient race, living nobly, and that his father was a notary by profession. This precludes the supposition, based largely upon his spirit of tolerance, that he was of Jewish or Moorish parentage, or both.

The Church of that day appealed most strongly to the ambitious as the direct path to influence and affluence so it is quite probable that the childhood training of Servetus at a neighboring convent was directed toward the priesthood. At the age of fourteen he entered the University of Saragossa, the most famous in Spain, where we are told he became proficient not only in Latin but also in Greek and Hebrew. After four or five years, having definitely decided against the clergy and probably with the hereditary vocation of his family in view, he entered Toulouse, the most noted law school of the day. He had not yet found himself but it is significant that here he made his first acquaintance with the scriptures of the Old and New Testaments. Leaving school after two years, Servetus next entered the service of Juan Quintana, a liberal Franciscan friar, confessor to the Emperor Charles v. It was as an unimportant member of the Emperor's retinue that he witnessed what was to him the degrading spectacle of the most powerful monarch of his time, at the head of twenty thousand veterans, prostrating himself in the dust to kiss the foot of the Pope. No less disgusting to the youthful observer was the thriving sale of indulgences by the clergy, an important feature of every festival. Servetus was also present at the Diet of Augsburg where he came into intimate contact with leaders of the Reformation, one author even making him visit Luther in the neighboring city of Coburg.

It is not clear when and why Servetus left the service of Quintana, but he is next found in Basle, corresponding on theological subjects with various Swiss Reformers. This led to the publication of his first book, "De Trinitatis Erroribus," or "Concerning the Errors of the Trinity." The title page also bore the legend, "By Michael Servetus, alias Revés, of Aragon, Spain." The printer and publisher, probably discerning the coming storm, did not grace the page with their names. The volume was immediately scathingly denounced as heresy and blasphemy, and Bucer, Oecolampadius, Zwingli and other leaders of the Reformation were quick to disclaim all responsibility for it or its author. "De Trinitatis Erroribus" dealt largely with the conception of the Holy Trinity, which among other doctrines the Reformers had retained after their revolt from Rome. This consisted of the existence of an inseparable and indivisible Godhead of three persons; God, the Father, Christ, the Son of God, and the Holy Ghost. According to the accepted dogma, Christ was the eternal Son of God, having existed since all time as the transcendental Word of God. Servetus did not deny the Trinity and was not a martyr to the Unitarian confession as is thought by some. In "De Trinitatis Erroribus" he states as his belief, "I concede one person of the Father, another person of the Son, another person of the Holy Ghost; three persons in one God, and this is the true Trinity." This seems orthodox enough, but person, he contended, as derived from the Greek προσώπου, or the Latin *persona*, means a mask, a symbol, an appearance, and never any real person or thing. To Servetus, Christ became the Son of God on his conception by the Virgin Mary and had not preexisted as the Word of God as recorded in St. John. His conception of the Holy Spirit is by no means so clear but it seems that he regarded both the Son and the Holy Ghost as manifestations of God and not as equal persons of the Godhead. "All Trinitarian errors," he concludes, "have arisen from not understanding the true nature of the Incarnation."

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The youthful critic was bitterly disappointed at the hostile reception of his views, and, living in an age when conflict with authority often led to the stake, he conveniently disappeared from Basle. His retreat was not, however, without a parting shot at his adversaries, for from Hagenau a few months later he published his "Dialogi de Trinitate," a reaffirmation of his views and an attempt to clarify them.

Leaving Protestant Switzerland for Catholic France, Michael Servetus became M. Michel Villeneuve; in Latin, Michael Villanovanus; not of Aragon in Spain but, for obvious reasons, from the former French province of Navarre. He studied mathematics and physics in Paris where, as a fellow student, he met Calvin, discussed theology with him, and first incurred the enmity which was so all important in his destiny. After two years Villeneuve is found in literary occupations successively at Orleans, Avignon, and finally at Lyons. Here he found employment as a proof reader and editor. An important work embellished with his notes was a handsome edition of "Ptolemy's Geography." Among the notations thereon is found the first recorded medical observation of this pioneer physiologist, "I have myself often seen the King touching many suffering from the disease (scrofula) but I did not see that any were cured." At Lyons, Villeneuve became the friend and associate of Symphorien Champier, a distinguished physician of his time. Both being students of astrology, Villeneuve did not hesitate to defend his friend against Leonard Fuchs, professor of medicine at Heidelberg, in a controversy on the subject.

The bitterness of his quarrels with the Reformers had perhaps discouraged him as a doctrinal critic, so Villeneuve is next seen again in Paris, this time as a medical student under the great Jacobus Sylvius and Johann Guinther, and a fellow prosector with Andreas Vesalius. As Servetus had freed himself of the bonds of orthodox theology, so Villeneuve and Vesalius threw off the shackles with which Galen had bound medical science for thirteen centuries, one instituting practical physiology, while the other became the father of modern anatomy. It is striking that the bigotry of their time claimed both men as victims, Vesalius perishing in a shipwreck off the Island of Crete whence he was returning from a pilgrimage to Jerusalem in an enforced penance for his zeal in dissection.

At the age of twenty-six or twenty-nine, Villeneuve published his only medical book, an unimportant treatise on syrups and their uses. In this work, however, he mentions veins originating in the mesentery, a distinct advance over the Galenian doctrine that the liver was the source of all these vessels. What he considered a much more important publication was his "Apologetica pro Astrologia," a defense of his lectures on astrology for which he was taken to task by the Paris faculty of medicine. Soon after his reprimand by that august body Villeneuve began the practice of medicine at Charlieu, a small town near Lyons. An abhorrer of infant baptism, he was baptized privately here at the age of thirty, at which age one had reached the capacity to reason and could have faith. To Villeneuve this was a prerequisite to the sacrament and for a precedent he pointed to Christ himself, who, though circumcised as an infant, was not baptized until His thirtieth year.

Soon leaving Charlieu for Vienne, a larger town in Dauphiny, Villeneuve began to practice there under the patronage of the Archbishop, Pierre Parmier, to whom he had lectured in Paris. His time not yet being fully occupied with his practice, he again engaged in editorial work, including another edition of "Ptolemy's Geography" and one of the famed "Pagnini's Bible." As an expositor of the latter he again established contact with the theological strife of the day. Through John Frelon, a publisher of Lyons, he began a correspondence with Calvin, in Geneva, on vital questions of Christian doctrine. The controversy gradually assumed such a degree of bitterness that the supply of invectives of both advocates was severely taxed. Although Villeneuve had in the meantime become a successful practitioner of medicine he seems never to have given up his life's ambition, the restoration of Christianity to what he considered its purity of form before it assumed the accretions of the various Church Councils. In the course of their correspondence Calvin sent to Villeneuve a copy of his "Institutiones Religionis Christiani." This was returned to its author copiously annotated on the margins, with the result that the enraged Calvin wrote his terribly compromising letter to Farel, "I will not pledge my faith to him; for did he come, if I should have any authority here, I should never suffer him to go away alive."

Servetus had long been preparing a volume which he hoped would do much to restore Christianity to the simple faith of the early Church. A manuscript of this "Christianismi Restitutio," or "Restoration of Christianity," he sent to Calvin for his opinion. The work dealt largely with the author's views on the Trinity, infant baptism, and the doctrine of justification by faith. Although Calvin did not condescend to comment upon such a blasphemous effort, he never returned the manuscript but at a later day furnished it to the Papal Inquisitor at Vienne for the prosecution of its author, his friend, for heresy.

The immediate cause of the prosecution at Vienne was the printing, in private, of five hundred bales of "Christianismi Restitutio" in that city. Villeneuve remembered the bitter experience of Servetus with "De Trinitatis Erroribus" and the title page bore neither his name nor that of the printer. It was signed with the initials "M. S. V." and in the preface he unwittingly says that he had previously treated of the subject to be discussed. Michael and Peter, too, are the interlocutors in one of the dialogues as indeed they were in his old "Dialogi de Trinitate." When the first copy of the printed book found its way into the hands of Calvin at Geneva he immediately recognized "M. S. V." as Michael Servetus Villanovanus, alias Michel Villeneuve, the physician, and denounced him to the ecclesiastical authorities of Vienne. This was cleverly accomplished through the medium of a controversial correspondence between two cousins, one a convert of Calvin's at Geneva and the other a Catholic at Vienne. At Calvin's instigation, the Protestant strictured his relative for harboring such a heretic as Villeneuve in his native city, the recipient of the missive turning it over to the Papal authorities. Calvin, at their request, supplied documentary evidence, including confidential correspondence from Villeneuve. Although the Viennese clerics must have laughed at the spectacle of one heretic accusing another, they immediately began proceedings which resulted in the arrest of the physician on a charge of blasphemy and heresy. He was allowed by influential friends to escape from prison but, after his flight, was tried and condemned to the stake. In his absence the fugitive was burned in effigy with five bales of his books on April seventh, 1553.

Why, of all places, Servetus should have gone to Geneva and into the hands of his arch enemy, Calvin, it is difficult to explain. The Genevese opponents of Calvin hoped soon to wrest control from their spiritual dictator, and it is supposed that discovery of such intentions led Servetus to submit himself as a pawn in the political game of the theocratic republic. At any rate, he was arrested at Calvin's instigation four weeks after he entered the city and was at once charged with the capital offense of heresy and blasphemy.

The trial rocked on for two long months and divided Geneva into two hostile camps. Personal animosity was demonstrated by Calvin in the injection of irrelevant material into the trial. Among other things, because of his celibacy, Servetus was charged with immorality. At times it seemed that Calvin was as much on trial as his opponent, who countercharged him with treachery, violation of confidence, connivance with the Papists of Vienne for his death, and with false imprisonment in that Geneva had no jurisdiction over him. Servetus was firm in his adherence to his convictions, however. Toward the middle of October public opinion, veered to the side of Calvin, forcing the council to declare the prisoner guilty.

Servetus, a peculiar combination of audacity and guilelessness, seemed never to have considered such a termination of the trial. He sent for Calvin and begged his pardon, but the Reformer remained adamant in his attitude that such a blasphemer was beyond the pale of mercy.

Near noon of the same day, October twenty-seventh, 1553, Servetus was led from his cell to receive his sentence of death at the stake by a slow fire. The Spaniard fell in supplication, asking, not for mercy, but for a less horrible form of execution. He was afraid, he confessed, that the intense agony of his suffering might cause him to be faithless to himself and to belie the convictions of his life. His plea refused, he arose from his knees and exclaimed in his native tongue, "O, God, save my soul; O Jesu, son of the eternal God, have mercy upon me." The death march at once formed; Farel, a local Calvinist minister, accompanying the condemned man in the procession and repeatedly urging him to recant.

When he reached the site of his execution Servetus again prostrated himself in prayer. Arising, he was chained to the stake with two of his books fastened to his waist; one in manuscript, previously sent to Calvin, and the other lately printed, the direct cause of his unhappy fate. A chaplet of green twigs, dipped in sulphur, surmounted his brow. As the leaping flames reached his face and ignited the sulphur, a single cry of anguish was extorted from their victim. The faggots, purposely green, burned slowly and Servetus suffered in silence for a long half hour until with an expiring breath he gasped aloud, "Jesu, Thou Son of the eternal God, have compassion upon me." As Osler has remarked, could he have only cried, "Jesu, Thou eternal Son of God," even his chains might have been loosed and the flaming embers scattered.

So thoroughly were his works suppressed by Catholic and Reformer alike that it was not until one hundred and forty years after the death of Servetus that the world became acquainted with his conception of the circulation. Willis translates from the fifth book of "Christianismi Restitutio" as follows:

> The vital spirit has its source in the left ventricle of the heart, the lungs aiding most essentially in its production. It is a fine, attenuated spirit, elaborated by the power of heat, of a crimson color and a fiery potency, the lucid vapor as it were of the blood, composed substantially of air, water and fire; for it is engendered by the mingling with inspired air of the more subtle portion of the blood which the right ventricle of the heart communicates to the left. This communication, however, does not take place through the septum, partition, or midwall of the heart, as is commonly believed, but by another admirable contrivance, the blood being transmitted from the pulmonary artery to the pulmonary vein by a lengthened passage through the lungs, in the course of which it is elaborated and becomes of a crimson

color. Mingled with the inspired air in this passage and freed from fuliginous vapors by the act of expiration, the mixture now being complete in every respect and the blood becomes a fit dwelling place of the vital spirit, it is finally attracted by diastole and reaches the left ventricle of the heart.

Now that the communication and elaboration takes place in the lungs in the manner described, we are assured by the conjunctions and communications of the pulmonary artery with the pulmonary vein. The great size of the pulmonary artery itself seems to declare how the matter stands; for the vessel would neither have been of such a size nor would such a force of the purest blood have been sent to the lungs for their nutrition only; neither would the heart have supplied the lungs in such a fashion, seeing as we do that the lungs in the foetus are nourished from another source, the membranes and valves of the heart not coming into play until the hour of birth, as Galen teaches. Consequently at the birth of the child the blood must be poured from the heart to the lungs for another purpose than the nourishment of those organs. Moreover, it is not simply air, but air mingled with blood that is returned from the lungs to the heart through the pulmonary vein.

It is in the lungs that the mixture of blood with inspired air takes place and it is in the lungs also, not in the heart, that the crimson color of the blood is acquired. There is not indeed capacity enough in the left ventricle for so great and important an elaboration, neither does it seem competent to produce the crimson color. To conclude, the septum, or middle portion of the heart, seeing that it is without vessels and special properties, is not competent to permit and accomplish the communication and elaboration in question, although it may be that some transudation occurs through it. It is by a mechanism similar to that by which transfusion from the vena porta to the vena cava takes place in the liver, in respect to the blood, that the communication from the pulmonary artery to the pulmonary vein takes place in the lungs with respect to the vital spirit.

As a monument to the zeal of bigotry "Christianismi Restitutio" is among the rarest of the world's rare books. Of the edition of two thousand printed at Vienne only two complete copies survive. One of these is in the Bibliothèque Nationale, in Paris, and another lies in the Royal and Imperial Library of Vienna. An incomplete copy, with the first sixteen pages in manuscript may be found at the University Library of Edinburgh.

The Paris copy passed from the collection of the Landgrave of Hesse into the hands of Dr. Richard Mead, of London, who undertook to have it printed in 1723 but while yet incomplete it was suppressed by the Bishop of London. Osler in 1910 was able to find but three copies of this incomplete reprint; two in the British Museum, and another in the National Library of France. Dr. Mead, to preserve the original from the Bishop's zeal, exchanged it with a member of the French Academy of Fine Arts. On the title page is found the name, "Germain Colladon," the barrister who prosecuted Servetus at Geneva. Stains upon some portions of the book, pronounced by experts to be due to scorching, seem to indicate this was the very copy used as evidence against its author and chained with him to the stake. It may be supposed that some zealous Calvinist rescued it from the stake and preserved it as a memento of such a great accomplishment for the glory of the Lord.

The Vienna copy was first brought to light as the possession of a Unitarian of Transylvania, resident in London, who on return to his native land presented it to the congregation of Claudiopolis, of which he was a member. It was given by them to Count Tekeli de Izek in return for some courtesy rendered by that personage. The Count, apprised of the value of the gift, presented the copy to his sovereign, the Emperor Joseph II, who placed it in its present home. The Austrian authorities permitted Dr. de Murr of Vienna to publish a facsimile reprint in 1791, such a counterpart of the original, indeed, that the date in minute type at the bottom of the final page, alone distinguishes it as spurious. This edition, being quite limited, is itself now very rare.

A physician, theologian and scholar, far in advance of his time, a vital actor in the great rebirth of learning, it is hardly as any of these that Servetus appeals to us most strongly. His loyalty to his convictions and the pathos of his fate have probably done more than all else to enhance his memory. To us, his description of the pulmonary circulation seventy years before Harvey perhaps seems to be the most remarkable contribution of his life. To Servetus, however, this was of so little import as compared to his theological convictions that he published it only as an illustration to clarify a controversial point. Of how much benefit might have been his life had he confined himself to his chosen profession, we can only conjecture. Unencumbered by the religious turmoil which removed him from the stage in his early forties, his keen intellect might have achieved as much for the world of science as he had so fondly hoped to accomplish for the souls of men.

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CEYLON (SINHALESE) OLAS OR BOOK MANUSCRIPTS ON EARLY MEDICINES AND HOW THEY WERE MADE

By ANDREAS NELL, M.D. M.R.C.S. (ENG.)

KANDY, CEYLON

AT the request of Dr. Casey Wood, who has been making a collection of Sinhalese books and manuscripts for McGill University, I have prepared the following account of the Ola. It is not complete, of course, but may assist readers to gain an idea of that interesting form of literature.

Ancient as well as modern Sinhalese olas (manuscripts) are written on tough, papyrus-like strips prepared from the immature, unopened fronds (spathe) of the Talipot and Palmyra palms. However, printing is now so cheap and so universal that it is likely to supersede the older method.

The store of old manuscripts in monastic and other libraries of Ceylon is considerable, but many ancient and medieval olas have gone abroad, chiefly to Petrograd, Berlin, Paris, London and America. The monastic libraries contain work of all sorts, as they were for many centuries the sole literary depositories. Recently, the Government of Ceylon has prohibited the export of important olas.

The subjects treated are religion, history, magic, geography, astronomy, medicine, grammar, folk-lore and local legends, crafts, poetry and short tales.

All the Ceylon chronicles are a mixture of myth, legend and actual history, but the realities in them are available, to serious students who study them in the light of other records, especially those of contemporary archeology.

Few of the books on astronomy, magic, medicine and grammar are indigenous; most of them, as well as much of the poetry, are copies of or adaptations from Sanskrit originals imported from India and copied or recast by monastic scribes.

On the other hand, the books on history and folk-lore are purely local compilations, as is the geography, although even that subject is embroidered with legendary tales.

The languages of the olas books are three, Sanskrit, Pali and Sinhalese. All the religious and historical works are in Pali (the language of Gautama Buddha), while some of the poems are also written in Pali with paraphrases in Sinhalese. Sanskrit is employed for secular works, some of which are written entirely in verse; others have a Sinhalese prose paraphrase following each of the verses.

The text of the local legends, the folk-lore, the geography and most of the poetry is in Sinhalese script, the character of which helps to date a manuscript that lacks the usual colophon on the last page. This tablet usually furnishes the title of the ola, the name of the author, the name of the patron ordering the manuscript, the name of the copyist and the date of the original in terms of the Buddhist era.

Some original works were composed as early as the fourth century A.D., but no ola-book of that period has so far been found, and the earliest known MSS. cannot be more than seven hundred years old, judged by the character of the Sinhalese script in which it was written, i.e., about A.D. 1250.

The books themselves, ancient, medieval and modern, appear as flat bundles of oblong leaves, uniformly 2¼ inches wide but varying in length from a few inches to 3 feet. The leaves are held between two board covers by a cord (wound round the book) attached at one end to a button or medallion, and at the other to a ball, tassel or simple knot.

The preparation of every part of the ola, as indeed of every appliance directly or indirectly connected with it, is definitely prescribed by custom, centuries old.

In the Tamil districts of Northern Ceylon the leaves are made from the Palmyra Palm (Borassus flabillifer), called, in the vernacular Tamil, Panna-maran. These palms, owing to the dry and hot climate of that region, seem to furnish the best paperlike material for inscription. Elsewhere in Ceylon both ancient and modern, olas are prepared from the leaves of the Talipot Palm (Corypha umbraculifera) in Sinhalese, Tal-gaha. Of these leaf preparations, two kinds are in use, an unfinished variety, or karakola, and the finished product, the puskola. The former is chiefly used as a copy book by the child learning to write with the blunt stylus, or ulkatuwa. As soon as he is proficient in making letters of correct shape, the pupil is permitted to wield the sharp stylus on the puskola. The copy letters are first traced by the teacher and the scholar repeatedly goes over them until his stylus pierces the ola.

The puskola is prepared as follows: The palm spathe being cut down just as it is about to open, the immature leaves are removed, the segments separated, and each midrib pulled out so that long, leafy strips are obtained. These are loosely made into rolls and placed in a copper cauldron of cold water, which is slowly raised to the boiling point and then allowed to boil or simmer for an hour. The strips are now dried in the sun for three days and then packed in reels about twelve inches across. The leaves are then exposed to the dews for three nights that they may acquire the suppleness demanded for the finished ola. It is not uncommon at this stage to store the olas in large rolls, but usually the preparation is completed as follows: across the tops of two upright posts a short length of the cylindrical and very hard Areca nut palm, rubbed very smooth, is fastened about three feet from the ground. The ola leaf is now weighted at the stalk end with a heavy stone, stretched over the Areca roller and a young monk or a neophyte pulls it by the other end, up and down, until one surface is thoroughly smooth and well polished. The strip is then turned over and the same treatment applied to the remaining surface.

The polished strips are now carefully cut into the required sizes and packed in piles. Holes are next cut or punched in them for the binding cords, and these perforations are made midway between the longitudinal sides, their exact positions being determined by an ancient rule embodied in a Sanskrit quatrain, whose translation reads something like this: "Fold the leaf in three; unfold; again fold in four; between the creases made by the foldings, place the holes." One ola thus perforated is the pattern for the rest of the leaves (which, of course, are not to be creased) and of the two flat boards or other form of covers, the latter to be slightly larger than the ola mass. Wooden pegs are now fitted into the two holes previously made in one board cover, the leaves strung on them, and the second cover clamped in place, the whole forming a firm, compact parcel. Finally, the edges of the bookleaves are singed with a hot iron, to remove stray fibres, the char also acting as a preservative and a precaution against the attacks of insects.

Each leaf of the ola is inscribed on both sides, making two pages. Sometimes, instead of keeping a large number of leaves in stock and in one cover, a small olas of a few paged leaves are selected, bound with proper boards, cord and button ready for the copyist or author. These booklets are used generally to write a prescription, clinical notes or address. Paging in Sinhalese is done, not by figures as in English, but by the letters of the alphabet.

The perforations in the pages provided for the binding cords are often separated from the writing space by some form of decoration made with the stylus and generally stained red. Sometimes anatomical or other illustrations of the text are introduced here.

Good ola writing in Sinhalese has been compared to a string of pearls; the letters should be evenly formed, regular in size and in line; and it may be said, in passing, that the ordinary manuscript is so written in striking contrast to the often slovenly and illegible chirography of the European.

The scribe, if right handed, cuts a notch in his left thumbnail, which has been allowed to grow long for the purpose, in the angle of which he rests his writing instrument (the stylus), like the sculling oar in the stern of a punt.

Two segments of the stylus were always made of steel, a sharp, cutting edge along one border of the upper, expanded portion or handle and the lowest part of the shaft with its pointed tip for scratching or engraving the letters and decorations on the ola. The body of the stylus was either of brass or iron damascened with silver or copper. Rarely an abbot or a nobleman had one made of silver, while the royal stylus was of gold. There were many lengths of the stylus, from 6 to 18 inches, but to preserve a proper balance of the various parts definite proportions of the various segments were many centuries ago assigned to them.

The scribe, with his stylus first trims (when necessary) the rough margin of the ola with the knife-like edge of the handle. Then, resting the lower part of the shaft in the notch cut in his left thumbnail he, using his right hand, adds the paging and writes the lines on the prepared leaf. In accomplishing this the leaf is laid on a table or board, but for short inscriptions the ola may be held in the four fingers of the left hand, the thumb being extended to guide the shaft of the stylus. After covering one surface of a leaf he repeats the process on the other surface of the ola, and so on until both aspects of all the olas in the book mass are covered.

The decorations and letters of the ola are made to stand out by filling the scratched areas and lines with either black or vermilion ink. The black application, almost invariably employed for the text, was a mixture of oil and lampblack, lightly rubbed over the surface of the leaf. Superfluous ink was removed with cotton or clean chaff, leaving only the pigment in the scratched lines. The oil employed for this mixture was prepared from the exudations of certain trees, the lampblack by a special process invented many ages ago.

The component leaves of an ola are not bound at the edges, as are modern paper-printed books, but as previously stated, the leaves are even more firmly held together by means of a cord run through the two holes in the ola mass and continued through corresponding perforations in the front and back covers. These covers were made of plain, carved, painted (oil painting was practiced in Ceylon several centuries B.C.) or lac-decorated wood, as well as of chased silver and carved ivory.

The binding cords were of plaited (native) cotton thread or they were manufactured from the tough fibres of the so-called "bow-string" hemp (Sanseviera zeylanica). Orthodox cords were plaited with either four or eight equally mixed red, white and blue strands, and the plaiting done in a certain prescribed manner. In ancient and medieval cords the cotton or hemp was home-grown and home-spun, the former of a gray-white color. The preparation of the red strands was a complicated process, the chief agent in the dye being chips of Sappan wood (Caesalpinia sappan). Blue dyeing was always effected with indigo, imported from India. When war or other causes interfered with the importation of indigo, the blue color was omitted from the plait; hence old cords made of red and white strands only are considered often to be of earlier origin than those with red, white and blue strands.

The binding cord was a long one; sometimes as much as nine feet or longer. Its length and the mode of winding it about the book were prescribed by very ancient usage. When in position it was prevented from slipping through the perforations in the ola by a medallion or button securely tied to one end, next the cover, and a ball or tassel woven into the free extremity. Sometimes a large knot or a colored or crystal bead displaced the orthodox ball and tassel.

The manuscript book was closed by winding the cord about it in an ordered fashion, the free end being finally passed around the button or medallion, or it was simply pushed under one or more of the binding strands. The ancient Sanskrit directs the winding of the cord, in this free translation: "The rule is, ten strings at top, five in the middle, three and three and pairs across." However in none of the large libraries was this regulation strictly followed, and one sees it modified in several ways, probably through carelessness. In numerous instances the cord is not passed through the second series of holes in the book-mass at all; or it is merely wound about the ola as in a badly tied parcel.

The ola button or medallion attached to one end of the binding cord was made of decorated or engraved horn, ivory, brass, copper or silver, or cut out of crystal. Occasionally a button of carved wood, ebony, ironwood, etc. was substituted for these medals. More recently, coins were sometimes used for the purpose.

Book covers were made mostly of wood, plain and decorated. The favorite woods for the better class covers were Ceylon ebony (the intensely black heartwood) highly polished but otherwise unadorned: Kino (Pterocarpus marsupium): Na, or ironwood (Mesua ferrea) and many others. Woods that readily take paint or lac were in considerable demand, such as Toon (Cedrea tonna), Sapu (Machelia champaca), Ceylon teak (Tectoria grandis), Milla (Vitex altissima) and (rarely) Jak (Artocarpus integrifolia). Valuable and rare covers of silver, either embossed, chased or set with gems, or of carved ivory decorated in gold and silver, were generally presents, from the king or great chiefs, to a monastery.

For ornamental purposes, as well as for the preservation of a valuable ola from dust and other forms of injury, manuscripts were often wrapped in a ceremonial kerchief of Kandyan embroidery.

The decorations, on the book covers, varied greatly. Treatises of medicine and magic, in addition to geometric, anatomical and astrological designs on the leaves of the ola itself, were often inscribed on the wooden covers. However, the chief motifs carved on covers were mostly in the shape of scroll work and floral designs; among the latter the jasmin flower, lotus bud, tendrils, etc. The rare, carved ivory and silver covers generally decorated with the conventional lotus bud, other ornaments being scroll work, whorls and various kinds of foliage.

Book covers of cheap, undecorated woods are sometimes found binding old and valuable olas. Probably, in such instances, the plain covers replace originally decorated bindings that have been removed and sold to collectors.

A special form of the ola was the sannasa (plural, sannas) or grant, a single leaf inscribed with a medical formula, a verse, a royal deed of land or an appointment to office. These were later replaced by thin copper sheets, the size of an ola. Many extensive tracts of land are held to this day in virtue of sannas originally granted to some great chief for achievements in war or peace. Monasteries of special renown possess silver sannas, while a gold sannasa belongs to a Vishnu temple, the Maha dewale, in Kandy.

THE ANESTHETIST'S DREAM*

By W. B. HOWELL, M.D.

MONTREAL

HISTORICAL note: John Abernethy was born in 1764 and died in 1831. He was surgeon to St. Bartholomew's Hospital, London, and founder of the medical school there. His manner, owing probably to his indifferent health, was brusque and irritable but there was no limit to his kindness of heart, especially where poor patients were concerned.

Sir Astley Cooper was born in 1768 and died in 1841. He was surgeon to Guy's Hospital, London. Good-looking, always in the best of health and good spirits, he was one of the most popular men in London and one of the busiest. His life was spent in going from one success to another.

Robert Liston was born in 1794 and died in 1847. He came to London from Edinburgh in 1835 to occupy the positions of surgeon to the North London Hospital and of professor of surgery at University College.

It will be noted that Abernethy and Cooper died before the dawn of anesthesia and Liston immediately after.

THE anesthetist had been out late the night before, and was very sleepy. He was supporting his head on one hand while from time to time he poured a few drops of ether on the mask and listened, half unconsciously, to the steady breathing of the patient. The operation had already lasted nearly three hours and had been borne well; there were no signs of shock nor, in fact, of any change for the worse. From time to time the ordinary sounds of the operating room, the querulous mumble of the surgeon, the click of one instrument against another, the soft footfall of a nurse, would become strangely remote, and the anesthetist's head would drop forward and then come back with a jerk. At such times he would open his eyes widely, and think that after all late hours did not pay; but that at least he would get a good sleep that night.

Suddenly he noticed a figure standing in the doorway, though he had heard no steps in the quiet corridor outside. No one but himself seemed to have observed an elderly man, with long untidy hair and in queer clothes, looking into the operating room with an expression of the most intense interest. The anesthetist noticed that the newcomer's coat fitted very badly. It had a very high collar and looked something like a modern dress coat, except that it could be buttoned almost up to the throat. Only two of the buttons, however, were actually fastened. The stranger also wore a stock of snowy whiteness, black silk knee breeches, silk stockings and old-fashioned shoes with silver buckles. Still unobserved by anyone but the anesthetist, he advanced slowly into the room, his fine dark eyes, which had a certain whimsical expression, seeming to take in everything. Curiously enough, there was no move on the part of the two young pupil nurses to hustle him into a white coat, to put a cap on his head and a mask on his face. He came up to the table and stood close beside the operator, who seemed unaware of his presence. One look at what the surgeon was doing (it was a resection of a part of the intestine), and an expression of amazement came over the visitor's face. He even—O horror of horrors—put a hand, which was none too clean, on the sterile towels covering the patient's chest, apparently to find out if he were breathing, yet strange to say, neither the surgeon, nor his assistants, nor the nurses took any notice of this frightful breach of etiquette.

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* Read during the Joint Meeting of the Canadian and Eastern Societies of Anesthetists and the American Society of Regional Anesthetists, Montreal, October 25–29, 1926.

Time seemed to stand still with the anesthetist. Afterwards he could not say how long the newcomer had stood there looking about him, before he heard a voice saying:

"What's going on here, Mr. Abernethy?" The question was asked by a second intruder. This was a man rather taller, with an inclination to portliness and the air of one whose merits fortune had always recognized. He had the look of health which is only to be found on the faces of elderly men who have lived on strictly hygienic lines, and who have taken special care to avoid excesses in drinking and eating. He was dressed like the first man but his clothes appeared fresher, as if they had a better acquaintance with the clothes brush. He had a particularly well-turned leg. The eagerness of the man addressed as Abernethy was unmistakable as he turned and said:

"Egad! It's a surgical operation, Cooper! And what's more they're doing something to the intestine. I don't understand a quarter of what's going on here, though I have been trying hard enough. The patient is asleep as far as I can make out. He doesn't move a muscle and no one's holding him. Do you see that chap sitting there pouring stuff on that white cloth arrangement over his face? Good God! Do you suppose they've found something which makes operations painless, puts the patient to sleep so that he feels nothing? Can that awful shrieking and struggling that used to make operations so horrible be a thing of the past?"

To which the second intruder, whom the anesthetist, with a curious lack of amazement, had recognized as Sir Astley Cooper, answered:

"I believe you're right, Mr. Abernethy. The patient must be asleep. He's inhaling some volatile substance which is evaporating on that thing covering his mouth and nose. What on earth can the stuff be?"

Before Abernethy could answer, a new voice with a broad Scotch accent, interposed with:

"Maybe Ah can tell ye, Sir Astley. It was introduced in mah time. It's sulphuric ether. A Yankee body foond it oot. Ye canna' feel onything when it's used. Ah was the first surgeon tae use it in England. Ah cut off a mon's leg and he felt naething; immediately afterwards said he didna' want the operation done, and couldna' stand it, and mind ye, the operation was over. Ah was stupefied masel.' "

The last comer was a big powerfully built man of middle age. He was dressed in a bottle green frock coat with a broad velvet collar, tight grey trousers with straps under his boots and a bright colored waistcoat crossed by an unnecessarily heavy gold watch chain. In spite of his baldness and his glossy black whiskers, he was handsome in a bold coarse way. Without the toothpick between his teeth he would have looked merely common; with it he looked vulgar.

"What year was that, Liston?" asked Abernethy of the last arrival.

"Aboot '45 Ah think it was; only a few years afore ma aneurism snuffed me oot."

"Do you know," said Abernethy, slowly, "I used to dream about something of the sort. What did you say the stuff was?" he asked Liston.

"Sulphuric ether."

"You don't say so," said Abernethy, in a low voice, "I remember ether, the stuff which evaporated so quickly and had such a strong smell—and I never suspected! What a difference it would have made! What work I could have done if it hadn't been for the screaming and the desperate need of haste. By God! how I used to hate operating! I couldn't get the cries out of my mind when I got home, and I never became accustomed to the look in the poor devil's faces when they felt they were tied down and couldn't escape."

"Yes, it was very trying indeed," Cooper answered. "The only thing to do of course was to keep the prospect of relieving the patient before one's mind. I felt very deeply for my patients."

"Ay, ay," said Liston, somewhat impatiently, "so did we a' but there was nae use bein' chicken-herrted aboot it."

"No, Liston," retorted Abernethy, "there never is any good being chicken-hearted about other people's pain."

"What used to hurt me a good deal," said Sir Astley, tactfully giving the conversation a new direction, "was the way people, especially women I had operated on, used to avoid me afterwards, even years afterwards sometimes. They'd some of them go miles out of their way on purpose to avoid meeting me."

"Yes," agreed Abernethy, "we all had that experience. The memories we revived were too terrible, I suppose. I remember once when I was dining at a friend's house, noticing a lady sitting opposite me, whose face seemed familiar but I couldn't recollect who she was. I had come in rather later than the rest of the guests and had not been presented to her. Her deathly paleness attracted my attention. It struck me after a while that she was purposely avoiding looking at me. Suddenly, as if she were forced to do it, she turned her face to me, leaned a little forward and looked straight at me and then she fainted. Egad! I never forgot the expression of those eyes. Well, she was carried out and looked after by a physician who happened to be there. After the company had settled down again I was told her name, and then I remembered. She was a young widow when I had met her, years before. I operated on her only son, a fine handsome boy of eight, for stone, and she had insisted on staying in the room during the operation. I hadn't had much experience at that time, it was at the beginning of my career. It was a very difficult case; took me, I am ashamed to say, the best part of an hour. The poor little beggar was brave at first. He seemed to realize what it meant for his mother. Then he lost control of himself. Poor boy, he died that night."

There was a pause during which the three watched the operation. The silence was broken by Liston.

"Ah used to wunner," he remarked, "when ether cam' in, whether it wouldna' spile surgeons, mak' them lose their cleverness wi' their han's. For ae thing, they could get sae muckle help. This gentleman's assistants dinna' hae tae haud the patient. They are free tae use their han's tae help in the operation itsel'. It's just as if the surgeon had three pairs o' han's instead o' ane. There's nae need tae mak' haste the noo. Ah dinna' suppose that they could dae onything quickly if they tried. Look at this chiel," he indicated the surgeon, "he's verra nearly asleep like his patient."

"What does it matter if he is slow," asked Abernethy, "if he can do better work by taking his time as of course he can. Look at the way he's putting in those stitches," he went on, "that's beautiful work. You couldn't do that quickly. There's nothing spectacular about him, I grant. That would spoil it for you, wouldn't it, Liston? I used to hear about your exhibitions in Edinburgh before gaping mobs."

"Ma work was nane the waur because a' the medical students and nearly a' the apothecaries in Edinbury cam' tae see me operate," said Liston, with a certain complacency. "It was ma business tae teach, and Ah taught."

"So it was my business, and it was Cooper's," answered Abernethy, sharply, "but we remembered the patient's feelings a little."

"This gentleman," interposed Sir Astley blandly, referring to the operator, "doesn't seem to attract many students."

"Perhaps," suggested Liston, "these twa' lassies are apprentices." He indicated, with a slight jerk of his head, the two pupil nurses standing near. "Ah wunner what premium they'd be payin'? No verra muckle, Ah'm thinking. Weel, it's just the sort of surgery women could dae. They couldna' hae done oor kind of surgery."

"I daresay," said Abernethy, "that they could do modern surgery a great deal better than you could, or any of us, for that matter."

"I'm wondering what the gloves are for; surely they must interfere with the sense of touch," said Cooper, changing the subject.

Liston's answer was prompt and contemptuous.

"To prevent the surgeons soilin' their saft white han's, probably."

"Well I shouldn't think that very likely, Mr. Liston. Perhaps it's an infectious case," answered Cooper.

"Maybe ye're recht, Sir Astley," was Liston's quick response. "If so, they've learned tae tak' michty guid care o' themsel's, these modern surgeons."

"They seem to be taking a good deal of care of the patient, too," interposed Abernethy. "See how clean everything is. There's not a speck of dirt anywhere. I shouldn't be surprised if all this dressing-up, and all these clean sheets and towels have to do with keeping something, dirt perhaps, out of the wound. The gloves, made of that smooth india-rubber could be kept cleaner than the skin of the hands."

"Yes," said Cooper, thoughtfully, "one misses the London dirt and grime here, agreeably of course. Look at the floor, not a sign of any mud or sawdust. I daresay the floor of your operating theatre at St. Bartholomew's was like ours at Guy's, fairly covered with mud on a winter's day, brought in on the dressers' boots from the street. Can it be that dirt got into the wound when we were operating and caused all that fever afterwards, and all the suppuration, and was perhaps the cause of so many dying."

"There were some wounds that healed by first intention," answered Abernethy. "Very few, of course, but we all saw them from time to time. It wasn't that they were kept any cleaner than the others, so far as I can remember."

"Maybe ye're recht, Mr. Abernethy," said Liston, "but Ah dinna' think they were ony cleaner, but Ah've aye said that nearly a' o' them were patients operated on in their ane hooses. They werena' hospital cases."

At this moment, the surgeon, who had been having some difficulty in stopping hemorrhage, lost his temper with one of his assistants, raised his head, glared fiercely at the offender, and said in a loud, rude voice:

"Lad, try not to be so stupid. You're here to help, not to hinder me."

There was a pause for a minute before Abernethy said quietly to Sir Astley:

"Well, surgery may have changed a good deal since our time, Cooper, but surgeons haven't."

The anesthetist just then felt a slight but persistent nudging. He suddenly realized that a nurse, who had been standing near him, was discreetly trying to attract his attention to the operator. It was only then that he heard the voice of the surgeon saying querulously:

"Can't you get him relaxed, doctor? I want to close. The muscles are like boards."

With a start the anesthetist applied himself to his task. He looked about him. The three visitors had gone.

OLOF RUDBECK THE ELDER*

By O. LARSELL, PH.D.

PORTLAND, ORE.

"AN hepar sit sanguificationis organum? Negatur." With this question and its brief but unequivocal answer, a twenty-two year old student overthrew the Galenic doctrine that the liver is the blood-forming organ of the body. This formula was the most significant of three questions with which Olof Rudbeck concluded his thesis, "De circulatione sanguinis," defended by him on May 22, 1652, as a student of Stenius at the University of Upsala. His conclusions were based on studies which resulted in one of the most important anatomical discoveries, from the point of view of function, of a century noteworthy for increase in knowledge of the structure and functions of the body. Although the formal thesis was not presented until the date indicated and the conclusions were not published until the following year, there appears to be no question as to Rudbeck's right to recognition as the discoverer of the lymphatic system, in the sense that he was the first to describe clearly the fundamental features of its significance. As a result of his discovery of lymphatics in the lungs, pancreas and pelvis, as well as in the liver, Rudbeck had already concluded that the "serous vessels," as he named them, exist not only in the mesentery, where they had been observed by numerous anatomists, but form a special system throughout the body. This was a generalization of first rank, based upon careful, well-planned experiments and observations.

The story of these discoveries can most simply be told in its natural setting by relating something of the life of the man who made them, which is itself not without interest.

Olof Rudbeck was born in Vesterås, Sweden, in 1630. His father, Johannes Rudbeck, was bishop of the diocese at the time, but earlier in life had been a professor at the University of Upsala. Anders Retzius[1] states that Johannes Rudbeck was the first teacher of anatomy in Sweden, although his teaching of this subject appears not to have been a part of his regular duties in the university. With his brother Petrus he established a private school of medicine at Upsala about 1613. Johannes lectured on botany, anatomy and physiology. Petrus dealt with diseases, their causes, etc. The venture appears to have been successful, for Johannes Rudbeck had fifty private students. It met with such opposition, however, by his colleagues on the university faculty that the king, Gustavus Adolphus, solved what threatened to become a serious problem by appointing Rudbeck, whose regular post was that of professor of theology, as royal chaplain. The school then was discontinued.

The subject of our sketch was the tenth of eleven children. His early education was at home and in the school at Vesterås. It is related that when he was in his eleventh year and his three older brothers were about to leave for the university at Upsala, Olof and his younger brothers begged so hard to be allowed to accompany them that their plea was granted at first. After having received this permission and having been properly fitted out and clothed for their new life at the university, the youngsters cut up such capers, however, that the good bishop, who, as chaplain, had accompanied Gustavus Adolphus on some of his military campaigns, thought it necessary to revoke his permission and to keep them at home under his paternal eye. Not until eight years later, in 1648, did Olof Rudbeck enter the University of Upsala.[2]

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*Contribution No. 124 from the Anatomical Laboratory, Northwestern Univ. Med. School.

Once there Rudbeck showed himself a capable and independent student. Not content to take the statements of the professors, he analyzed and worked things out for himself. He became particularly interested in natural history and related subjects, and as one of his biographers[2] puts it, he sensed the great unity of nature. His sharp eyes and clear brain saw many things that escaped others.

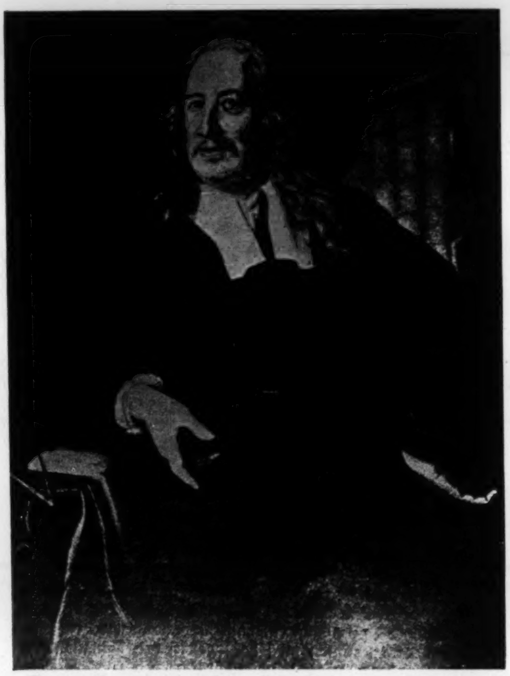


FIG. 1. PORTRAIT OF OLOF RUDBECK, FROM PAINTING BY MARTIN MITJENS, REPRODUCED FROM GRIMBERG'S "SVENSKA FOLKETS UNDERBARA ÖDEN."

Johannes Frank, after the older Rudbeck's transfer to other duties, had established lectures in anatomy[1] in the university in 1624, and also taught botany. Stenius lectured on physiology and also did some work in anatomy. Rudbeck studied under both of these teachers and apparently received his direction toward natural science from them, although his father had also undoubtedly had an important part in stimulating the boy's interest in nature.

His attention was first attracted to the lymphatic system by his chance presence while some women were dressing a newly slaughtered calf. When the heart was removed, Rudbeck noted a whitish fluid trickling down from the superior vena cava. On searching for its source, he observed the thoracic duct and followed this vessel downward to a dilatation filled with milky fluid.[3] This was all that it was possible for him to do at the time. These observations were made in 1650, when Rudbeck was twenty years of age. During the remainder of this year other pressing duties prevented the young observer from pursuing his discovery, but his interest was aroused and the following year he continued his experiments. He tied off parts of the mesentery at various points, and also parts of the thoracic duct, and observed the chyle pass through the vena cava into the chambers of the heart, after the great vein had been emptied of blood. It was not, however, until later that he recognized the opening of the thoracic duct into the subclavian vein, which latter he called "vena axillaris." In these observations Rudbeck independently made the same discoveries that Pecquet had made in 1647 and published in 1651. But he had gone further than Pecquet by his observations on the lymphatics of various viscera and especially by his experiments on the lymphatics of the liver. These experiments consisted in placing ligatures around the portal vein and the bile duct, so that the lymphatic vessels swelled up between the ligature and the liver. When the ligature was loosened the fluid streamed toward the pancreas. When applied again the vessels became swollen anew. Thus Rudbeck showed that the lymph vessels of the liver carry serous fluid, not to this organ, but away from it. From this discovery he drew the conclusion that the liver is not a blood-forming organ, receiving its raw materials directly from the chyle vessels, as was generally believed, but that it is a blood-purifying organ.

Rudbeck was not the first to observe lymphatic vessels. His claim to distinction rests rather on the fact that he made more numerous and more new observations than others before him, and more important still, that he was able to interpret what he saw anatomically and recognize its physiological significance.[3] It is stated that Rudbeck made observations on 400 animals in his researches before April, 1652.[4]

Lymphatic vessels were apparently seen by Aristotle [322–380 B.C.]. Herophilus [300 B.C.] and Erasistratus [280 B.C.] observed the chyliferous vessels, the former noting their terminations in the mesenteric glands and the latter their milky contents, according to the Galenic writings. Herophilus regarded these vessels as arteries and Erasistratus thought them to be veins. Galen denied these observations, and they were forgotten.[5] Not until 1532 was new attention directed to the lymphatics. In this year Nicolas Massa appears to have seen some of the renal lymphatic vessels. Somewhat later Fallopius discovered small white vessels, evidently terminating in the lymph glands about the pancreas. Eustachius, in 1563, saw the thoracic duct in the horse and called it "vena alba thoracis." He also saw the inferior "enlargement," probably the cisterna chyli. Discovery of the right lymphatic duct is usually accredited to Stensen. The chyle vessels of the intestine were discovered by Caspar Aselli, at Pavia, in 1622. On July twenty-third of that year, Aselli did a vivisection on a dog to demonstrate certain nerves. By chance the dog had been fed a short time previously and when Aselli opened the abdomen he saw many fine, white strands passing through the mesentery. On cutting one he saw, to his great surprise, a fluid exude, and on subsequent repetition of this experiment he observed these vessels and obtained the whitish fluid only when the animal had been fed a short time previously. He is said to have repeated his observations on many animals, including the dog, cat, lamb, cow, pig and horse.[5] This discovery by Aselli, made six years before Harvey's publication, "De motu cordis et sanguinis," was of great importance and appeared to contain the solution of a very perplexing problem, namely, how the liver received its raw material for the function, ascribed to it by Galen and still held in Aselli's time, of blood formation. Before Aselli's discovery of the chyle vessels it was thought that the chyle was carried by the veins of the mesentery from the gut to the liver, there to be converted into blood.[3] How could these veins at the same time carry blood to the intestines and chyle to the liver? According to the ideas of the time the blood flowed peripheralward in the veins and therefore in an opposite direction to the course which the chyle must take. Some anatomists and physiologists of the time thought that the blood and the chyle, unlike fluids as they are, could and did pass within the same vessel in opposite directions at the same time. Others believed that these unlike fluids were carried by the same veins in opposite directions alternately, still others held to the view that certain veins carried blood and other veins carried chyle.

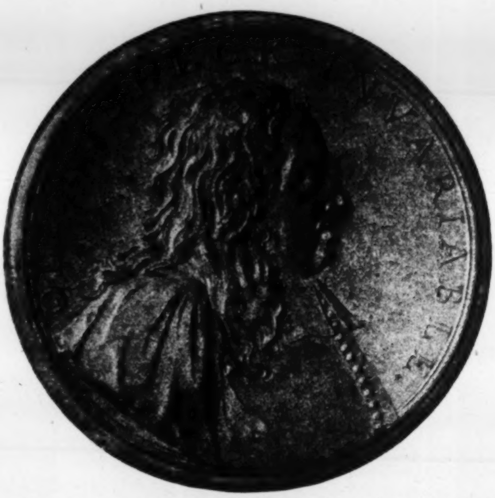


FIG. 2. OLOF RUDBECK, IVORY RELIEF IN NATIONAL HISTORICAL MUSEUM OF SWEDEN, REPRODUCED FROM HILDEBRAND'S "SVERIGES HISTORIA."

This discovery of Aselli, which however was denied by Harvey and Riolan,[5] even as the observations of Erasistratus and Herophilus had been denied by Galen more than fourteen hundred years earlier, therefore clarified the entire question. It explained how the chyle was carried from the intestine, but Aselli did not follow the course of this fluid through the thoracic duct. He thought rather that it passed through the pancreas of Aselli and thence into the liver, a mistake due to the fact that Aselli, who had observed lymphatic vessels between the liver and the mesentery, took these to be continuations of the chyle vessels carrying fluid to the liver, not away from this organ. Despite the opposition of Harvey and Riolan, the correctness of Aselli's discovery was proved by the researches of Gassendi [1628], Vessling [1634], Folius and Tulpius [1639], Wallée [1641] and Pecquet [1649]. Through this discovery of the chyle vessels, coupled with the error concerning the lymphatics of the liver, the Galenic teaching that the liver is the primary blood-forming organ, appeared to receive strong support. Aselli's discovery of the lacteals, made on animals, was confirmed on the human subject in 1628, when Gassendi and de Peirsc, in Aix, saw the chyle vessels in an executed criminal. This individual had been given a rich meal before being put to death and was dissected one and one-half hours after execution, so the chyliferous vessels were plainly visible.

Pecquet, in 1647, discovered the thoracic duct in dogs, and saw that the chyle vessels lead past the liver, not into it, to terminate in a dilatation at the end of the thoracic duct, the cisterna chyli or *receptaculum Pecqueti*. He also showed, by tying off the thoracic duct, that it swelled up below the ligature and emptied above this point. Therefore it must carry fluid from the intestine toward the heart. He further showed the relation of the duct to the venous system. It is of interest to note that these discoveries were made by Pecquet as a twenty-five year old student of medicine and had their initial impulse in a chance observation of a milky fluid escaping from the thoracic duct during a dissection of a dog. Thus we find a close parallel to Rudbeck's discovery of the same structures. This observation, undoubtedly made by others, as His[6] states, Pecquet followed up systematically until he could draw well-based conclusions as to its significance. These conclusions and observations were published in 1651.

By describing clearly the connection between chyle vessels, thoracic duct and subclavian vein, Pecquet had shown how the chyle reaches the blood stream, passing by the liver. The physiological position of this organ as the blood-forming organ was shaken, as a result, by the observations of Aselli and others, of lymph vessels between the liver and mesentery, which were interpreted to be chyliferous ducts, leading to the teaching that part of the chyle passes into the liver and part passes into the blood stream through the thoracic duct.[3]

It has already been stated that Pecquet published his observations in 1651. In the meantime the young Swede studying at Upsala[7] and in entire ignorance of the work being done by his French contemporary,[8] but no doubt familiar with the earlier work of Aselli and others, was led to his important discoveries and deductions, by a chance observation which he had the sagacity to pursue intensively. By 1651 he had independently made the same discoveries regarding the thoracic duct, its relation to the chyle vessels and its opening into the subclavian vein, as had Pecquet.

In April, 1652, he demonstrated the lymph vessels of the liver and their significance before Queen Christina and her court and a large part of the university.[9] It was on this occasion that Rudbeck learned for the first time of Pecquet's work, published the preceding year. In June, 1652, Rudbeck received a copy of Pecquet's published account of his observations from Doctor Palmcron, one of the Queen's physicians.[10] While Aselli had observed the lymphatics of the liver, neither he nor his successors recognized that they carry fluid from the liver. Rudbeck's studies of these vessels in various organs made it possible for him to reach the generalization already stated, namely, that in all parts of the body there are vessels which carry a clear, nearly colorless, serous fluid, the lymph, from the organs and extremities toward the heart. He showed that these vessels unite with the chyle vessels from the intestine to form a single main vessel, the thoracic duct, which discharges into the left subclavian vein. Thus alongside the blood vascular system, which Harvey had elucidated twenty-four years earlier, Rudbeck now placed a second important system of vessels, that of the lymphatics.

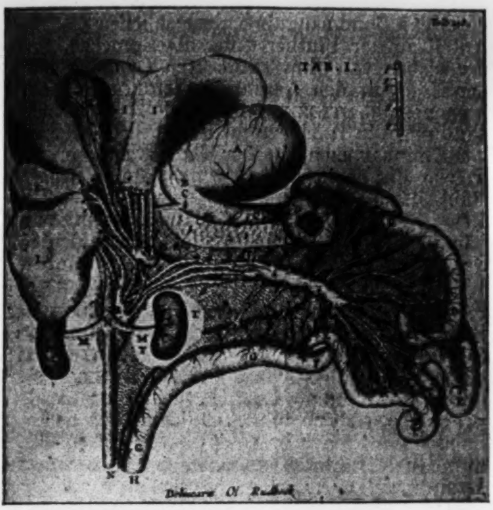


FIG. 3. RUDBECK'S DRAWING OF THE LYMPHATICS OF THE LIVER, THE LACTEALS AND THE CISTERNA CHYLAE [MESSIS AUREA, 1659]. FROM BARTELS, "DAS LYMPHGEFÄSSSYSTEM."

In the meantime, in apparent ignorance of Rudbeck's observations, Thomas Bartholin was also studying the lymphatic vessels in Copenhagen. Bartholin's investigations on this subject were as equally unknown to Rudbeck; not until August sixteenth, 1653, did Rudbeck learn of Bartholin's work, through the discovery in a bookshop in Hamburg of the Danish anatomist's "Vasa lymphatica nuper Hafniae in animantibus inventa." This treatise was published by Bartholin in May, 1653, and was discovered by Rudbeck while on his way to Holland. We can well imagine the feelings of the young student at finding the results of his own work in large part duplicated, and published by one of the leading anatomists of Europe. Rudbeck's own treatise was not published until the summer of 1653, at Vesterås, under the title "Nova excertatio anatomica exhibens Ductus Hepaticus Aquosus et Vasa Glandularum Serosa, nunc primum inventa, aeneisque figuris delineata." In the meantime however he had presented his results under the title "De circulatione sanguinis," which he defended as his thesis at Upsala, in May, 1652. In it he formulated his conclusions, in part. He had also given the public demonstration in April of that year.

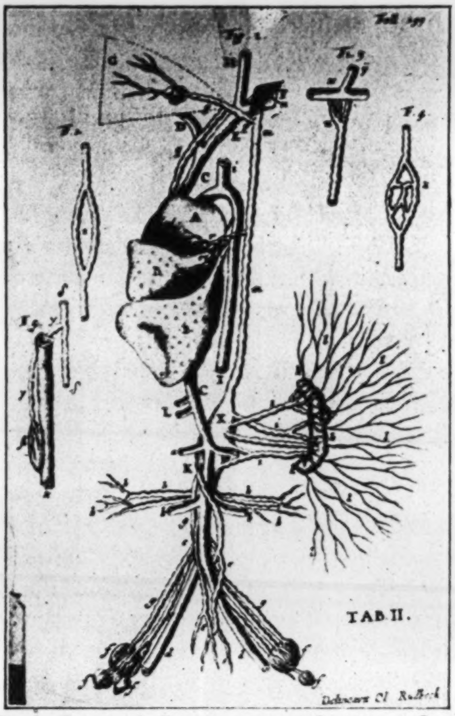


FIG. 4. RUDBECK'S DRAWING OF THE LYMPHATIC SYSTEM [MESSIS AUREA, 1659]. FROM BARTELS, "DAS LYMPHGEFÄSSSYSTEM."

The Queen had been so impressed with the promise of the young anatomist at this demonstration that she made it possible for him to go to Holland, for further studies. He started on this journey in the summer of 1653, hence his presence in Hamburg in August.

The appearance of Rudbeck's treatise started a bitter controversy between himself and Bartholin, chiefly through Bartholin's pupil, Martin Bogdan, in which the latter claimed the honor of discovery for his teacher. Without going into the details of the dispute, we may accept the admirable summary of Bartels,[10] who has had access to documents not readily available in this country. Bartels states that in December, 1651, Bartholin demonstrated to Bourdelot the thoracic duct, and at this time saw the lymphatics of the liver, which however he took to be chyle vessels. On February twenty-eighth, 1652, [December 15, 1651, according to Bogdan] Bartholin, with his prosector Lyser, saw the lymphatics between the kidneys and the cisterna chyli, as well as those along the inferior vena cava from the iliac fossa and the lymph vessels of the extremities. At this time, however, Bartholin did not catch their significance. He considered them in part chyle vessels, in part anomalies, and continued to hold the orthodox view that the liver was the blood-forming organ. Not until May, 1653, in his "Vasa lymphatica nuper Hafniae in animantibus inventa et hepatis exequiae" did he use the name "lymphatics" for the newly discovered vessels, and indicate a change of views concerning the function of the liver. His change in the latter respect was however so complete, that as Hammarsten states "he is not content, as Rudbeck, with dethroning the liver from this *nobilissimum officium* [as the blood-forming organ] but considers the liver as dead and erects a gravestone over it."[3]

Rudbeck's ideas were clear on this subject of the liver's place in relation to the lymphatic system as early, at least, as May, 1652. Otherwise he could not have defended his difficult thesis that the liver is not the blood-forming organ.[3] In his "Nova exercitatio" [1653] he gives the reasons for his views, and takes Pecquet to task for his oversight concerning the liver. Rudbeck deals with the lymphatics of the liver under the term "ductus hepatici aquosi," with those of the rest of the body under the title "vasa glandularum serosa," and clearly shows the relation between them. In his figures, published in 1659 [Messis aurea] these relations are beautifully shown. His earlier figures have not been available to me.

Rudbeck showed that in different parts of the body there are tubes which carry a clear, serous fluid from the organs and limbs toward the heart. He further showed that these vessels unite with the chyle vessels from the intestine to form a single trunk, the thoracic duct, which discharges into the left subclavian vein. Although Rudbeck and Bartholin made their discoveries independently, the former's work was done earlier, but Bartholin made his discoveries known by publication some months prior to Rudbeck. With reference to the function of the liver, Rudbeck's demonstration in April of 1652, before the Queen, and the thesis defended a month later, shows that he was the first to clearly present his results, although not in regular published form. It does not appear unreasonable to take the view of Bartels that the demonstration before the court and a large part of the university should be recognized as equivalent to publication in regular form. Rudbeck thus elucidated the lymphatics of the liver, as well as some other parts of the body, in April, 1652, and, through his thesis, published his conclusions on the physiology of the liver a whole year earlier than Bartholin. The latter's term "lymphatic system" was adopted by scientific men generally, rather than Rudbeck's "vasa serosa." This was probably due, in large part, to Bartholin's position as a well-known anatomist, no doubt also to the fact that some of his students, especially Moinichen and Bogdan, demonstrated the newly discovered system in Germany, France, Italy and England to the "unbelieving and skeptical."[10] In this way they performed a real service to the cause of anatomy in spreading the new knowledge and added to the fame of their teacher.

Discussion of such controversy is unprofitable, except as it calls attention to a real contribution to medical science, and seeks to do justice to one of those who made it.

Wilhelm His,[6] Tigerstedt,[11] Hammarsten,[3] and Bartels,[10] who have had access to documents not available in this country, appear agreed that to Rudbeck belongs the credit of first discovery and demonstration, while to Bartholin belongs the credit for first publication in printed form. Hammarsten summarizes with the statement:

> The chief honor due Rudbeck is that he, a young student, completed a work which by wealth of observation, better prepared drawings, a deeper insight into and nearer approach of results, together with great independence in interpretation and clearer grasp of the meaning of his observations, is thus entitled to greater scientific credit than the same work which under similar circumstances would be done by the learned professor, one of the foremost anatomists of the time.

Rudbeck concluded with reference to the functions of the liver and the "primum sanguificationis organum," in his view apparently, the heart, as follows:

> Even as ordinary cooking requires not only fire but also kettles, skillets, etc., through which that which is being cooked is purified and freed from scum, so in nature the heart is not alone to be considered. It requires help of other organs, e.g., the spleen for fermentation, the kidneys for freeing from watery parts, and the liver for freeing from bile and the new fluid [lymph]. Only after this is complete is the blood serviceable for the nourishment of the body.

He concludes that the foremost functions of the liver are to separate the bile from the blood, which is brought prepared from the spleen to the liver; to filter from the blood the watery fluid [lymph]; and through the hepatic lymph ducts, to carry the latter to the chyle sac. Only after it is thus purified is the blood ready to nourish the body.[3] It is surprising that Rudbeck apparently overlooked the fact that filtering the lymph from the blood of the liver, which blood reaches the heart through the inferior vena cava, only to have that same lymph finally enter the same chamber of the heart via the thoracic duct and superior vena cava, could make but little difference in the formation of the blood in the heart, which as already stated, he seems to have considered the chief blood-forming organ. In Rudbeck's time the only known way by which nutritive fluids could be absorbed from the intestine was through the chyle vessels, and his conclusions regarding the function of the liver were, in the main, the logical result of his anatomical discoveries.

His thesis, "De circulatione sanguinis," in addition to his own observations on the lymphatic vessels, contained a correct presentation of the blood-vascular system, based in large part on his own researches and experiments,[12] as well as on those of the discoverer of the circulation of the blood, William Harvey.

With this brilliant introduction into the fields of anatomy and physiology, Rudbeck's year of study in The Netherlands gave promise of the most fruitful results. However, his versatile genius found there so many things of interest that anatomy had to share with many other subjects. He sought to master everything in the way of knowledge that he encountered in this country, the center of learning and artisanship. Craftsmanship, for which he had a strong bent, as shown by his making a clock out of wood as a boy at Vesterås, and technical knowledge and skill in many fields, were acquired along with the subjects of the universities. Botany greatly attracted his interest and became a strong rival to anatomy, later eclipsing his first love entirely.

Rudbeck returned to Upsala in 1654, having refused flattering offers to remain in foreign lands.[9] He became docent in botany and was made adjunct professor of medicine in 1655, ex. o. professor in 1658, and o. o. professor in 1660. In 1661, at thirty-one years of age, he was made rector of the university, and became for many years the most powerful figure in its affairs. In the meantime he had entered upon his teaching with enthusiasm. One of the first things he attempted on his return to Upsala was to give a public demonstration of his collections in Holland. He carefully arranged his specimens, chiefly botanical, but waited in vain for an audience. It was a great disappointment to the young naturalist, but only spurred him to new endeavors. He had formulated in Holland a strong desire to establish a botanic garden in his own university, and this project he began in 1658. Fortunately he secured the interest of the new chancellor of the kingdom, M. G. de la Gardie, early in his efforts, and his future became assured, both in his pet project and in his own advancement. In a few years he could boast that his botanic garden was second only to that in Paris. His teaching was in the most diversified subjects. By request of the faculty to the chancellor, Rudbeck was assigned to lecture on botany and anatomy, while his old teacher, Stenius, was to teach "physic" and allied subjects. This arrangement continued until 1661, when Rudbeck took over all that was included under "physic," then equivalent to natural science.[13] He soon had added instruction in mechanics, astronomy, chemistry [in which he gave private lessons], mathematics, music, drawing and architecture. The young men of the university crowded about him and soon he became the outstanding figure in the institution through his energy, his geniality and his excessive powers of labor. It is stated that "he handled this colossal work almost as if it were play."[9] It was but natural that he should be selected rector.

As rector he was loaded with duties. Ambitious for his institution, with the chancellor approving almost everything he undertook, and with tremendous zeal and capacity for management, he began a program for expansion of the university. He erected buildings, serving both as builder and architect, constructed water works and undertook many other projects, too numerous to elaborate. Of the building program, erection of an anatomical laboratory and enlargement of the university library building, the *Gustavianum*, were the most important. The water-supply system was constructed of wooden pipes from the castle, where was located the reservoir into which water was pumped from the river. It extended through the town and into his pet botanic garden. The entire length of the system was nearly two and one-half English miles.[9]

With all his energy and ability, the multiplicity of duties could not but deleteriously affect his teaching. He was warned at a sitting of the consistory in 1664, but the warning developed into personal feeling which only made trouble. Rudbeck however continued in the chancellor's favor and kept up his manifold activities. One of the most noteworthy of his plans in its potentialities, which however was doomed to failure because of inadequate financial support, was his attempt to establish a technical school. He constructed models in which twenty-seven different machines, including hammers, pumps, drills, etc., were driven by one wheel.[2] He offered to teach, free of cost to the government, all possible subjects, from masonry to shipbuilding; and in spite of the failure of this projected institution to materialize, he trained a large number of surveyors, engineers, coppersmiths and other craftsmen in various lines. As an example of his own craftsmanship, it is related that during the Danish war [1658], when there was urgent demand for compasses for the fleet, he himself made fifty of these instruments, and thus enabled the vessels to leave port on their warlike business.

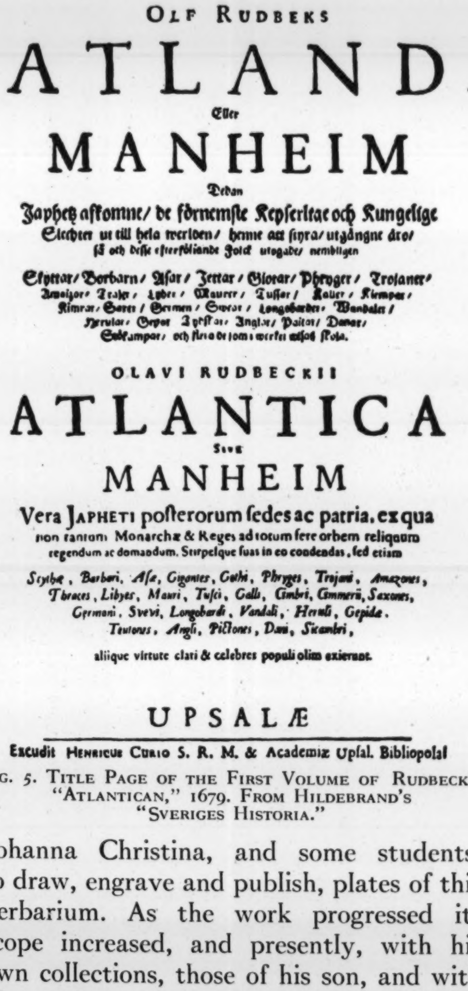
The war brought in its wake financial stringency in which the university could not escape a share. Rudbeck, with his great power and self-confidence, had made numerous enemies on the faculty. When financial difficulties came, he personally was held responsible. Many of his colleagues had entertained little sympathy for him or his plans, and it was only through his great influence with the chancellor that he had been able to carry most of them through, brushing aside many of the legal forms of procedure. When the university finances reached so low an ebb that the professors were not always paid in full, the bitterness came to the surface in various ways. Rudbeck and the chancellor were blamed for their zeal in enlarging the university at the expense of the professors. Rudbeck's point of view is summed up in his bitter answer to the just complaints: "I believe that we here must have the religion which is the summum bonum, when we receive a full salary."[15] Good feeling was finally restored, only to give way again to grumbling.

For many years Rudbeck appears to have been the stormy petrel in one quarrel after another, some of which shook the university to its foundations and "brought more than one professor to an early grave."[9] In some of these controversies Rudbeck appears arbitrary, in others he was on the side of progress. Always he was independent. Something of his arbitrary side is shown in an incident in which he was able to hinder the printing of a treatise, "Scondia Illustrata," by Messini, because certain statements in it cast doubt on the correctness of his own views concerning Sweden's antiquity. On the other hand, through two long and bitter struggles, he championed the new Cartesian philosophy against the old scholasticism, in the university.[9,15] The perennial struggle of current orthodoxy in religion against new ideas in philosophy was the basis, in large part, of these controversies. The priesthood of the country desired to establish a national censorship of the teaching in the schools but to this curtailment of its freedom the faculty was opposed. A large part of the faculty, however, could not allow the free teaching of the new and, to many, dangerous doctrines, without vigorous protest. An illuminating insight into conditions is afforded by Rudbeck's sarcastic comment, which also shows his own point of view and modern method of approach to truth:

> However primitive was the natural philosophy of the time, yet there were few who would depart from it . . . With a word it resolved many difficulties without blackening the hands with charcoal in chemistry, neither did one get backache from inquiring into the nature of earths, metals and minerals, nor did the stomach become weak from dissecting, nor the eyes from staying awake nights to observe the peculiarities of the stars, etc., but in a warm house by fictitious words and distinctions, men became learned and he was held most learned who could think in the most subtle manner.

A committee representing both factions of the faculty was appointed to settle the quarrel. It reached a compromise, which however was a setback for Cartesianism. The king finally brought about a cessation of hostilities by giving out the decree, in 1689, that Christian truth need not be based on any philosophic system but should be allowed the free use of all philosophy.

Botany came to absorb more and more of Rudbeck's scientific interest. From 1681 to 1690 he lectured entirely on this subject and for a period of sixteen years there is no mention in his letters of anatomical studies.[9] From 1685 his colleague, Drossander, held the chair of anatomy and physic. Rudbeck appears to have entirely deserted the field in which he first gained prominence. As a botanist, however, he was untiring and established this subject in Sweden. His botanical studies received a powerful impetus through the fortunes of war. In the struggles between Denmark and Sweden, the herbarium of Joachim Burser fell into the hands of the Swedes. This herbarium was the result of years of collecting in various parts of Europe. It came into the possession of Hofrath J. Coyet, whom Rudbeck besought as soon as he heard of it, to present the collection to the university. This Coyet did in 1666, and Rudbeck, perhaps with the recent experience in mind of the easy possibility of destruction of so valuable a collection, began the great task of publishing in their natural colors and so far as possible in natural size, figures of these plants. He received promises of financial aid from the king, Karl XI and from the national chancellor, Carl Oxenstierna, also from M. G. de la Gardie, but this aid did



OLF RUDBEKS
ATLAND
Eller
MANHEIM
Dedan
Japhetz afkomne/ de förnemſte Keyſerliga och Kungelige
Slechter ut till hela werlden/ henne att ſtyra/ utgångne äro/
ſå och deſſe efterföljande Folck utogade/ nembligen
Skyttar/ Barbarn/ Aſar/ Jettar/ Glotar/ Phryger/ Trojaner/
Amaizor/ Traker/ Lyber/ Maurer/ Tuſſer/ Kaller/ Kimpar/
Kimrar/ Goter/ Germen/ Swear/ Longobarder/ Wandaler/
Herular/ Gepar/ Tyſkar/ Anglar/ Paitar/ Danar/
Swikampar/ och flera de ſom i werket wiſas ſkola.

OLAVI RUDBECKII
ATLANTICA
Sive
MANHEIM
Vera JAPHETI poſterorum ſedes ac patria, ex qua
non tantum Monarchæ & Reges ad totum fere orbem reliquum
regendum ac domandum, Stirpeſque ſuas in eo condendas, ſed etiam
Scythæ, Barbari, Aſæ, Gigantes, Gothi, Phryges, Trojani, Amazones,
Thraces, Libyes, Mauri, Tuſci, Galli, Cimbri, Cimmerii, Saxones,
Germani, Svevi, Longobardi, Vandali, Heruli, Gepidæ,
Teutones, Angli, Pictones, Dani, Sicambri,
aliique virtute clari & celebres populi olim exierunt.

UPSALÆ
Excudit HENRICUS CURIO S. R. M. & Academiæ Upſal. Bibliopola.

FIG. 5. TITLE PAGE OF THE FIRST VOLUME OF RUDBECK'S "ATLANTICAN," 1679. FROM HILDEBRAND'S "SVERIGES HISTORIA."

not materialize. The wars in which Sweden had been engaged for many years had finally made themselves severely felt financially. Undaunted, Rudbeck set to work, with the help of his son, Olof Rudbeck the younger, two daughters, Wendela and Johanna Christina, and some students, to draw, engrave and publish, plates of this herbarium. As the work progressed its scope increased, and presently, with his own collections, those of his son, and with plants from his botanic garden, it grew into the monumental "Campus Elysii," of twelve large volumes. Just as the publication was being completed in 1702, a fire which destroyed nearly the entire city of Upsala resulted in the loss of this great work. Rudbeck, now seventy-two years old, took the loss of so much labor and expense in a philosophical spirit. In a letter[9] to the chancellor he writes concerning it, "The Lord has given, the Lord has taken away; blessed be the name of the Lord." Ten of the volumes have subsequently been recovered, and Swederus[14] describes them as follows: "The figures are true to nature and drawn by a master hand. Here and there the color is faded, but most of them have a freshness as if they were drawn yesterday instead of more than two hundred years ago." The plates were originally nearly seven thousand in number of which six thousand one hundred were recovered. Swederus calls "this giant work of Olof Rudbeck on the plants of his time . . . the greatest in the world."

In his botanical work he was always alert for new material. When his son made a journey to the continent he sent home to the father the most minute descriptions of the plants he encountered. When the government, in 1695, was about to undertake a survey of the then little known northern part of Sweden [Norbotten], Rudbeck, too old and occupied himself to accompany the expedition, made arrangements for the younger Rudbeck to do so, with the purpose of collecting the plants, birds and animals of this region.

In Rudbeck's own mind his most important work, which he expected to bring him enduring fame, was of quite a different character than his studies in natural science. This was his "Atlantican," a work which had its inception, apparently in large degree, in Rudbeck's intense patriotism and his delving into the ancient sagas of his country. With the emergence of Sweden as a world power during the early part of the seventeenth century, the national consciousness was quickened, and not unlike other nations in more recent times, anything that would add to the lustre of glory was gladly welcomed. Great interest in Sweden's past was aroused, and in 1629, Gustavus Adolphus stimulated a search for antiquities of whatever kind. This interest was further enhanced by the museum of antiquities established in 1667, under Karl XI. Folksongs, sagas and other products of the past, were eagerly sought. Anything that would magnify the importance of the Swedes was accepted with little question. An antiquarian lexicon of the time by Verelius (1691) states that the Goths who took Rome came from Sweden.[9] Against this background we behold Olof Rudbeck, intensely patriotic, magnificently energetic, interested in everything, but with a fatal lack of training in history. In his desire to add to the honor of Sweden, now that it had astonished the world with its military exploits, he undertook to collect everything in classic and ancient literature which might be interpreted, by the widest stretch of imagination, to pertain to his country. To him the Greek story of "Atlantis" was perfectly clear. Frithiof's saga was in his eyes, the Greek account in Northern terms. Sweden was the Atlantis of the ancients. By juggling with words, he explained the entire Greek mythology in Swedish terms and history. Furthermore, to Rudbeck, Sweden was the land to which Japheth found his way after the flood of Noah. Why did Japheth seek Sweden? Its clear winters, beautiful summers, freedom from contagious diseases, these, with other advantages, was his answer. Thus Rudbeck showed a spirit not unknown at the present time in various parts of our own country. From Japheth, according to the "Atlantican," descended all the kings of the earth. They spread to various lands to rule them. Europe also was peopled by Japheth's descendants, some of whom migrated from Sweden.

Around this sometimes hidden but always central theme of his country's glorification were collected the wildest phantasies and imaginings. Annerstedt says that true scholarship and geniality glimmer like nuggets of gold in the unorganized matrix of Rudbeck's own imaginations and citations from the authors of all times and all lands. Part I of the "Atlantican," a folio volume of eight hundred ninety-one pages, appeared in 1679; part II in 1689; part III in 1698 and part IV in 1702.[16]

This work attracted the most widespread interest at the time. Through this and his other works, Rudbeck became the most sought out personage in Upsala. The French ambassador to Sweden is stated to have said that next to his Bible, he read most assiduously the "Atlantican." In 1699 the Polish ambassador was to visit Upsala, and for political reasons it was arranged that he should have a royal welcome. Through some delay the retinue did not arrive in time for the evening banquet which had been arranged, and Rudbeck went home and to bed. When the ambassador finally arrived during the night, and Rudbeck, no longer rector, was sent for, he objected to leaving his bed at midnight "to cook and boil." The next day, at a visit to one of the shrines of the city, the ambassador, who up to that moment had not met Rudbeck, asked his host the rector, who was the distinguished-looking individual who stood out from the throng. On the subject of our sketch being thereupon presented, the ambassador addressed him in so stately a manner that at first Rudbeck thought the foreigner had

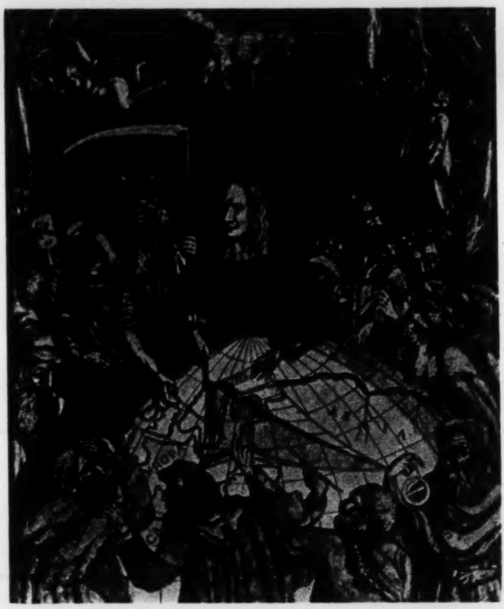


Fig. 6. Olof Rudbeck Lecturing on Atlantis. Comtemporary Copper-plate. From Grimsberg's "Svenska Folkets Underbara Öden." Note the Audience, Composed in Part of Plato, Aristotle and Other Notables of Antiquity.

made a mistake and thought him a Roman cardinal. But when he spoke of possessing the first part of the "Atlantican" and desired to have the other two parts then published, Rudbeck writes "I could do nothing else, after he had so annointed my head with that copious balm that, as with Aaron, it flowed down into my beard, but give him the other two parts of the Atlantican."[9] Of the banquet which was finally given in the ambassador's honor with many toasts, Rudbeck writes, apparently with reference to the ambassador's ability to keep from under the table, "I do not know if my wife has kissed me so much for a year as he and his high ranking attendants did the rector magnifico and myself and some of the other professors."

On top of his scholarly work Rudbeck had an important part in many other affairs, chiefly of a public nature. He was, in his prime, considered the best engineer in the country. His mechanical genius he turned in many directions, in addition to the construction of university buildings, already mentioned. He built a bridge across the river without cost to the city of Upsala. He started a printery and bookshop. He established a postal and passenger service between his city and Stockholm, by water. During the months from April to November when the water was free of ice, decked boats made the trip three times per week. Because some of the passengers left the boats at the end of the journey without paying their fare, Rudbeck solved the problem thus raised very simply by instructing the skipper to cast anchor some distance from shore until all fares were paid. "Since," as he said, "such a craft which must sail daily and never rest long and must have a skipper and six boatmen, is not maintained alone by the weather." Another rule, due to his objection to tobacco, was that "those who have a love of tobacco can sit on the deck in the fresh air."[9] In connection with his various public works may be mentioned his proposal for a canal between the Baltic and the Cattegat, although this project was not carried out in his day.

One of the last glimpses we have of him, although this is in the nature of a tradition, is of an old man with flowing hair on the roof of the university library building in the great fire of 1702, directing those who were attempting to save the building.[15] When told that his own house, containing his manuscripts, the labor of many years, was on fire, he merely continued his finally successful efforts to save the library. A few days after the fire Rudbeck sat down to work out a new city plan for Upsala, which was accepted. Shortly afterward he was taken suddenly ill in the midst of his work and after a few days of sickness died, on September seventeenth, 1702. In his death the University of Upsala lost its greatest figure before the day of Linneaus, and natural science a student of rare ability and capacity for labor.

In estimating Rudbeck's contributions, outside those which more directly affected his own country, one is at a loss whether to most regret his departure from anatomy in which was done his most brilliant and enduring work, from the standpoint of pure science; whether most to rejoice that he entered botany and thus undoubtedly prepared the way for Linneaus, who named the genus *Rudbeckia* after him; or to hold that the cause of science in general, perhaps benefited most by his administrative service to the university in modernizing it and smoothing the way for the long list of notable scholars who from its walls have enriched the entire world of learning. Unfortunately he himself based his hopes for permanent fame in a field of work in which he was unprepared. While he received honor in his lifetime from the "Atlantican," it has since cast unjust discredit on much of his other work, in other respects undeserved. In the world of ideas and established scientific fact Rudbeck is worthy of a permanent place, if for no other reason, for the one brilliant gem of his student days at

Upsala by which he established the lymphatics as a system of vessels, side by side with the blood vessels. In its influence on physiology and medicine, this discovery ranks among the most noteworthy contributions to the knowledge of the structure of the body.

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* Rudbeck never studied at Padua, as stated by Meyer-Steineg and Sudhoff, and some other writers. His work on the lymphatics was all done at Upsala. Similarly, there is some question as to whether Pecquet made his discovery at Padua, as is usually stated. According to Baker, Pecquet's work was done at Montpelier.

For various viewpoints reference may be made to Sprengel, "Versuch einer pragmatischen Geschichte der Arzheilunde," 1801; Daremberg, "Histoire des Sciences Médicales," 1870; von Haller, "Elementa physiologiae," 1757; and other early treatises and works on medical history.

THE PALEOPATHOLOGY OF PATAGONIA

By ROY L. MOODIE, PH.D.

SANTA MONICA, CALIF.

THE prehistory of South America has heretofore largely centered around the Peruvian area occupied by the pre-Columbian people and their associates in nearby regions to the exclusion of other races. Investigations into the nature of the Andean peoples have resulted in a large amount of detailed information of the greatest value.

Other races of people with widely different culture inhabited different parts of South America and their claims to antiquity have been reviewed.[1] The scanty evidences of disease[2] and injury have already been given. At that time I had not seen the work of Verneau[3] on the ancient, pre-Columbian Patagonians and this note purposes to consider the evidences as given by that author. His work, granted a prize for its excellence, was based by Verneau on collections preserved in the museums at Paris, which at that time (1903) were considerable. The work is handsomely printed on beautiful paper and the plates are excellent.

Our author gives an historical review of the geographical discoveries, the scientific explorations of Darwin and Cunningham, and the anthropological work of Moreno, Ameghino, Burmeister and others. The chronology of prehistoric events in Patagonia is indefinite and we are not told how the author knows his material to be definitely pre-Columbian, or how ancient the races were. The absence of European evidences indicates the antiquity of the burials. Much of his material came from the divisions Rio Negro and Chubut near the southern extremity of Argentina, for in 1881 the territory known as Patagonia was divided between Chile and the republic of Argentina.

As in all general anthropological collections our author finds examples of anomalies, injuries and disease quite rare. Among anomalies of the head he finds distorted sutures, Wormian and epactal bones, anomalous occipital condyles and certain dental anomalies. Variations in the number of vertebrae, ribs, bifid spinous processes, and an os acromiale all seem to represent developmental disturbances. The conditions are made clear by pen drawings carefully executed.

The pathological conditions discovered, discussed and figured are: luxations, fractures, arthritides and ankyloses, necroses, osteitis, exostoses (surface osteomata), atrophy and the lesions seen in hydrocephaly and microcephaly. Diseases of the teeth and palate are not mentioned, nor are there any evidences of primitive surgery, either trephining or cauterization.

His discussion of the single example of luxation is interesting and the illustration (Pl. x, 4) shows extensive alterations of the acetabulum where a large pseudarthrosis had developed. Unfortunately the femur is not illustrated or described.

The two fractures are briefly considered, one of the face and one of the fibula. A flint arrowpoint penetrating the manubrium sterni is shown in Plate xii, 47. The weapon had penetrated the entire thorax, entering from the back and penetrating the posterior surface of the sternum, projecting well beyond the surface.

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[1] Hrdlička, A., Early man in South America, in collaboration with W. H. Holmes, Bailey Willis, and Fred Eugene Wright, and Clarence N. Fenner. *Bull. 52, Smithson. Institution, Bur. Am. Ethnol.*, Wash., 1912.

[2] Moodie, R. L. Paleopathology. Chicago, 1923, Chap. xv.

[3] Verneau, R. Les Anciens Patagons. Contribution a l'Étude des Races pré-colombiennes de l'Amérique du Sud. Publiée par ordre de S. A. S. le Prince Albert I^{er}, Prince souverain de Monaco, 1903. Anomalies et lésions pathologiques, Chap. v, 211–231, Pl. x, xii, fig. 47. Figs. 36–43.

The nature of the arthritides is not given except for a coxofemoral ankylosis which is shown in Figure 41.

A small, ivory-like osteoma on the right frontal (Pl. x, 2) recalls similar exostoses in Peruvian crania. A depressed fracture (Pl. x, 3) recalls the numerous sling-shot injuries described in pre-Columbian crania from Cinco Cerros, Peru. The author asks if these lesions are evidences of syphilis, but stops there.

Verneau's diagnosis of hydrocephalus and demimicrocephalous crania is questionable, but one would have to examine the material to be sure.

Our author's contribution to Paleopathology is of great interest and finds its nearest relations with the pre-Columbian Peruvians. The vertex of one Patagonian skull (Pl. x, 1) shows a perforated area exactly like those seen in pre-Columbian crania, and which I have regarded[4] as an early stage in the development of the huge tumor mass, hyperostosis cranii, which grows in response to pressure irritability by a meningioma.

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[4] Moodie, R. L. Studies in paleopathology, xviii. Tumors of the head among pre-Columbian Peruvians. Annals of Medical History, 1926, viii, 394–412, 15 figs.

EDITORIAL

DR. NICOLAS LEÓN*

Some time ago, Colonel Garrison called my attention to the fact that little honor has been paid by the medical profession of North America to one of its most distinguished members. To be sure, Dr. Nicolas León is better known as an ethnologist, anthropologist, philologist, archeologist and historian than as a physician, but his contributions to science have been so extensive and he has shown so many of the marks of genius that we should all be proud to esteem him as a member of our profession.

Dr. León was born on December sixth, 1859, at Quiroga, in the State of Michoacan, Mexico. After graduating in medicine from the College of St. Nicolas (Morelia) in 1883, he became professor of pathology and obstetrics in that institution, and, at later intervals also taught Latin, botany, natural history and anthropology.

In 1894, assisted by the Regent of the College of St. Nicolas, Dr. León founded a Museum of Natural History in Morelia; in 1886, he founded one in Michoacan, and in 1891 one in Oaxaca. The Museum of Michoacan has become famous not only in Mexico but throughout the world. In the course of building up its collections, Dr. León has come into friendly contact with most of the leaders in ethnologic research of Europe and America.

In 1900, Dr. León[1] joined the staff of the National Museum in the City of Mexico, where he is still active as head of the Department of Anthropology. He founded the Department of Mexican Ethnology, and was the first in Mexico to give instruction in this branch of science. The better to prepare himself for the work he studied intensively with Dr. Hrdlička of our own National Museum [Washington] and made many trips to the United States and Europe, usually as delegate from Mexico to scientific congresses. Most of what is known about the archeology and early history of the State of Michoacan is due to his tireless energy and tremendous productivity. His bibliography alone covers thirty-six closely printed pages. With all these activities, he has found time to practice medicine, to study the history of medicine in Mexico, to assist in editing a medical journal, to be obstetrician to the hospital in Morelia (1910), president of the National Academy of Medicine, and Chief of the Department of Statistics in the Institute of Hygiene. He is known and esteemed in Europe as the leading medical historian and anthropologist of his country and one of its greatest bibliographers. His "History of Obstetrics in Mexico" (1910) is a fascinating, well illustrated piece of original research, constructed out of hand from native materials and owing nothing to European sources. His bibliography of Mexican literature in the eighteenth century (1902–7) is classical.

As so often happens in a young civilization, the scientist who is highly honored and appreciated abroad remains comparatively unappreciated and unaided at home. Someone has defined genius as that inborn tendency in a man which causes him to keep driving onward toward his goal in spite of every obstacle that is thrown in his path. This is surely exemplified in the life of Dr. León, whose contributions to science would be remarkable enough if made in a large institution, with the friendly support and stimulus of sympathetic fellow workers; actually, the work has been done on his own initiative, in a country where scientists are not always appreciated and where they have sometimes been annoyed and thwarted by ignorant and jealous politicians.

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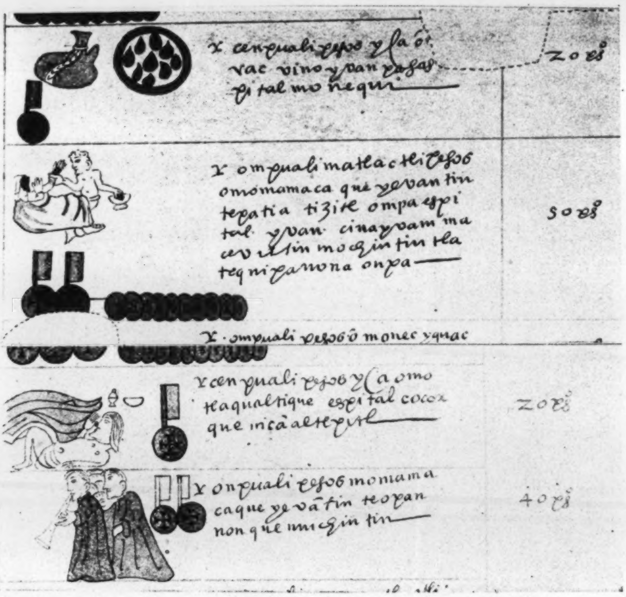
* Mexican Historian, Ethnologist, and Anthropologist: An appreciation, with brief comment on the Sierra Codex.

[1] León: Bibliografia mexicana del siglo xviii, v. 1–5, Mexico, 1902–1907.

THE SIERRA CODEX

One of the most interesting of the early Mexican documents edited and published by Dr. León is the "Texupan" or "Sierra Codex." This was discovered in 1892, in a small museum in the City of Puebla. It is an ancient account book, recording the disbursements of a little town in Oaxaca, which existed in the time of Cortez, but which has since disappeared. The book appears to have been kept by an Indian who used European script but wrote in Nahuatl, one of the principal languages of ancient Mexico. It is hard to understand why he did not keep the accounts in Spanish, but possibly another book was kept for the few Spanish officials, and this one, with its colored pictures or primitive hieroglyphs on the margin, was kept for the benefit of the more intelligent Indians. Some statements made by the scribe, however, suggest that the Indians were carrying a large share of the financial responsibility. Thus, in one place, he notes that a certain amount was spent for imported foods such as olive oil, fish, and shrimps "for the Spaniards as we have agreed to do."


20 ps
50 ps
20 ps
40 ps

CUTS FROM THE SIERRA CODEX SHOWING FIRST, A SKIN OF WINE AND A PACKAGE OF RAISINS FOR THE HOSPITAL; SECOND AND THIRD, PATIENTS IN THE HOSPITAL; FOURTH, A RELIGIOUS PROCESSION.

From statements in the account book, we discover the astounding fact that in Mexico of 1550, there existed a communistic village, paying its expenses out of profits derived from the raising of silk and sheep. Silkworm eggs were bought by the community and distributed to its members; and a Spaniard, who received a percentage of the profits, superintended the production of the silk with such success that in one year they sold the produce for 3550 pesos. In addition, they realized 250 pesos from the sale of sheep and cheese, and occasionally they made a neat sum by buying a herd of cattle and selling them again after the animals had been fattened. Their expenses were small, as they paid only a few pesos to their shepherds, and a few more to the silk spinners. One can get an idea of values in those days by noting that two horses cost seventy-five pesos, and two shepherd dogs seven pesos, and that the priest could be boarded for sixty pesos a year.

One gets the impression from American school histories that the New England town meeting was a unique institution, but here, a hundred years before, we find a group of people who appear to have discussed their finances in open meeting, and who were quite ready to express their disapproval of some of the things done. At one time, the town invested in a farm, but some of the citizens, not approving of the venture, withdrew. On another occasion, after 150 pesos had been spent for a grand state dinner, it appears that there was some doubt in the minds of the authorities as to the way in which the expense account would be received, so the scribe adds, "All this was very necessary!"

It is remarkable to find this village not only using the modern term community chest (*caja de communidad*), but using the surplus largely for the expenses of the church, the public feast days and the hospital. As one would expect in a community dominated by sixteenth century Spaniards, practically all the spare cash went into the building and maintenance of the church, and most of the items in the book refer to expenditures on this score. Much money was spent also for public feasting during the many church festivals and for entertainment of visiting bishops. When the chief magistrate made rounds with his retinue, the town spent from twenty to forty pesos on his food, but when the bishop came, they spent fifty-seven pesos for cocoa, turkeys, wine, and other good things to eat and drink. Seventy-two pesos were spent at Easter for candles, wine and food "which were necessary for the feasting."

It is remarkable to find that, in 1552, this village was able to purchase a church organ in Mexico City. A hymnal costing thirty-two pesos had to be imported from Spain, but when they were ready for the church bell, they paid one Simon de Buenaventura to come and make it on the spot. They paid him 740 pesos for his labor, twenty-two pesos for his board, and fifty-seven pesos for the necessary metal. As they became more prosperous they felt the need for emulating their neighbors and we find them ordering a wonderful velvet embroidered altar cloth, "which would be as good as the one in Oaxaca."

One finds a number of curious references to the hospital. As usual, the physician was paid little in some years and nothing in others. He apparently had some Indian as assistant and possibly was an Indian himself. Strange to say, I can find but one reference to the purchase of ordinary foods, and none suggesting the purchase of drugs. The main idea seemed to be to regale the patients with candies and sweets. Thus, I find that, in 1561, ten pesos were paid out for sugar and honey, "which they needed in the hospital," and later thirty pesos were spent for wine, candy and raisins "these things were for the hospital which needed them very badly." On another occasion they bought two pounds of oil and forty yards of Spanish cloth from which to make mattresses.

The illustration shows a naked patient lying on the ground with a dark green object above him, possibly intended to represent the effluvium of the disease. In the distance, are two dishes containing food and to the right is a picture of the money which was paid for it. Another picture shows a sick man covered by a blanket. His face and one hand are painted green, so possibly he was suffering from yellow fever. Just why he should be thumbing his nose at the male nurse who is going to give him a sponge bath is not clear.

I wish to thank Colonel Garrison and Mr. Hoeber who lent me copies of the "Codex" and the mimeographed translation by Dr. León, and Mrs. Fanny Bandelier of Mexico City who supplied me with biographical data. I am sure all the readers of the ANNALS OF MEDICAL HISTORY will join in good wishes to Dr. León and in the hope that for many more years he may live to pursue his varied avocations.

WALTER C. ALVAREZ, M.D.

BOOK REVIEWS

The Radcliffe Infirmary. By Alexander George Gibson. London, Humphrey Milford, Oxford University Press, 1927.

In that most amusing and veracious chronicle of the medical history of England, "The Gold Headed Cane," Dr. Radcliffe is represented as telling Dr. Mead that when he was urged to marry some young gentlewoman to get heirs by, he was wont to reply that he had already an old one to take care of, who would also be his executrix, intending thereby the University of Oxford. Accordingly, when Radcliffe died in 1714, it was found that he had left the bulk of his estate as a trust to be administered by the Master and Fellows of University College, Oxford. Osler says there is probably no name in the medical profession associated with so many benefactions. We need only mention the Radcliffe Observatory, the Radcliffe Library and the Radcliffe Travelling Fellowships, of which Dr. Nias has published such an interesting account. In 1758, forty-four years after Radcliffe's death, the Trustees voted to provide out of his benefaction the money necessary to erect an infirmary or hospital in the city of Oxford. The ground on which it was built was generously donated by Thomas Rowney, a well-known citizen of Oxford, of which he had been the representative in Parliament a number of years. There were various delays in the erection and furnishing of the Infirmary so that it was not opened for the reception of patients until 1770, since which it has continued its beneficient work with ever increasing activity down to the present day. Dr. Gibson's book is a model of what a history of such an institution should be. It gives all the details regarding its construction, growth and management, and full information concerning those who have served it either as administrators or on the staff. A very interesting explanation is given of the interrelationship between the University's medical school and the Infirmary. In later years much was done by Sir Henry Ackland, Burdon Sanderson and Osler to increase the usefulness of the Infirmary to the medical students at Oxford. The name of the Radcliffe Infirmary is so familiar to all the members of our profession that such an authoritative history of its activities is most welcome.

Francis R. Packard.

Sieben Defensionen. Drei Bücher: Durch den Hochgelerten Herrn Theophrastum von Hohenheim Paracelsum Genant Beider Erzney Doctorn. 1. Das erst Buch: die verantwortung uber etzlich verunglimpfung seiner missgünner. 2. Das ander von dem, Irrgang und Labyrinth der Artzten das sey in andere Büchern lehrnen Sollen dann bissher geschehen. 3. Das dritt von dem ursprung und herkommen der Tartarischen kranckheiten nach dem alten namem vom Stein Sandt oder Griess auch heilung der selbigen. Gedruckt zu Cöln. Durch die Erben Arnoldi Byrckmanni. Anno 1564. Mit Keis. Maiest. Gnad und Freyheit. [Facsimile.]

A welcome gift of the current year from the Leipzic Institute of the History of Medicine is this facsimile edition of Paracelsus' most revealing work. As explained by Professor Sigerist in a short epilogue (which, with an equally short one page prologue, is the only modern text in the booklet), these "defenses" were written three years before his death to justify him to himself and to the world. His defense not only of his professional career but of his character and his way of life cannot but prove interesting. Thus the medieval characters and the quaintness of expression, so valuable in conveying atmosphere, become worth even the considerable struggle required for their mastery by the foreigner.

E. B. Krumbhaar.

Medicos Portugueses, Revista Bio-Bibliographica. Vol. 1, 1925–1926, 4 nos.

This interesting publication is devoted to biographical and bibliographical material concerning eminent Portuguese physicians. Each number is devoted to a single man, those thus honored being José Antonio Serrano, Maximiano Lemos, Sousa Martins and Miguel Bombarda. The latter took a very prominent part in politics, being an ardent republican and anti-clerical. His assassination in 1910 produced a great sensation. In spite of his political activities Bombarda achieved much prominence as a writer on subjects connected with public health and psychiatry. Sousa Martins was internationally known as an internist and clinical pathologist of the best type. Maximiano Lemos did splendid work in medical history. For a number of years he edited a journal devoted to the history of Portuguese medicine. Serrano was a distinguished anatomist and surgeon. The pages in which these biographic sketches are written are illustrated not only with portraits of the usual type but with caricatures and humorous pictures which contrast curiously with the gravity of the text. *Medicos Portugueses* is produced in very handsome form with many illustrations. It will serve a most useful purpose in bringing to the attention, especially of the Anglo-Saxon medical profession, the really excellent work done by so many teachers and practitioners in a country with which few of us are as familiar as we should be. The journal is published and edited by Ramiro Barros e Silva to whom we wish all success in his undertaking.

PIONEER MEDICINE IN WESTERN PENNSYLVANIA. BY THEODORE DILLER, M.D. FOREWORD BY J. J. BUCHANAN, M.D. NEW YORK, PAUL B. HOEBER, INC., 1927.

This little work preserves a great amount of valuable historical material concerning the medical profession in the early days, when Pittsburgh was Fort Pitt and the huge industrial development of that part of the United States was in the distant and unforeseen future, so much so that in 1784, Arthur Lee is quoted, by Diller, as writing of Pittsburgh: "There are four attorneys, two doctors, and no priest of any persuasion, neither church nor chapel, so that they are likely to be damned without the benefit of Clergy . . . the place I believe will never be very considerable." Fortunately others had faith and their labors laid the foundations of its future greatness.

Among the physicians whose names are associated with the early history of Pennsylvania were a number who distinguished themselves more in the military than in the medical profession. Thus Diller recites the services of Dr. Edward Hand, who became a Major General in the Continental Army; Dr. Arthur St. Clair, attained the same rank, but his military fame was tarnished when, after the Revolution, he allowed an expeditionary force under his command to be ambushed and defeated by Indians; Dr. Hugh Mercer, better known to fame as Brigadier General Mercer, the hero of the battle of Princeton, in which he fell; Dr. William Irvine, at one time Commandant at Fort Pitt, later commanded, as Brigadier General, the Pennsylvania troops in the Whiskey Insurrection. When John Braddock came over with an expeditionary force he was accompanied by a young Scotchman named James Craik, who dressed the General's wounds after his defeat by the French and Indians. Later Craik served as physician-in-chief in the Continental Army. He was Washington's personal physician, as well as his intimate friend. In 1770, he accompanied Washington on his visit to Fort Pitt. The first medical man to settle as a practitioner in Pittsburgh was Dr. Nathaniel Bedford, who had been attached as surgeon to the British garrison in Fort Pitt. He had as apprentice Peter Mowry, who succeeded to most of his preceptor's large practice. Dr. Diller gives a vivid picture of the difficulties by which medical practice was beset in these early days, when the doctor riding alone on horseback in the sparsely settled region was in danger of attack by Indians, as well as by the wild outlaws who frequented the country. A notable early practitioner was Francis Julius Le Moyne, the pioneer of cremation, who built the first crematory in the United States. Dr. Joseph Doddridge combined divinity with medicine, the "angelical conjunction" of Cotton Mather. He was ordained by Bishop White of Philadelphia, in 1800. While studying divinity he had attended medical lectures and on his return to Pittsburgh he exercised both professions, apparently with great success. Dr. Diller quotes extensively from Doddridge's "Notes on the Settlement and Indian Wars of the Western Parts of Virginia and Pennsylvania," which were compiled in 1824.

Of the later figures in Pittsburgh medical annals, one of the most notable was the able but eccentric surgeon Albert G. Walter. He especially distinguished himself as an orthopedic surgeon, but in January, 1859, he performed an abdominal section for the relief of ruptured bladder, which is claimed to have been the first operation of its kind. It was reported in the *Medical and Surgical Reporter*, November sixteenth, 1861. Unfortunately Walter was irascible and censorious, and in consequence became an object of dislike to most of his colleagues.

Dr. Diller concludes his book with an account or the medical organizations and hospitals of Pittsburgh. He has done a great service to medical history in preserving a quantity of valuable material which was rapidly disappearing with the advance of time.

Kurze Geschichte Der Chirurgie. Von W. von Brunn, Professor Für Geschichte Der Medizin An Der Universität Rostock. Mit 317 Abbildungen. Berlin, Julius Springer, 1928.

Although entitled a "short history" of surgery this work of Professor Brunn's is much more comprehensive than most of the more extensive works which attempt to cover the field. Beginning with a resumé of all that is known of the surgical procedures, employed by prehistoric or primitive peoples, Brunn passes to a consideration of the history of the art as preserved in the stone or other drawings and writings of the Egyptians, Chinese, East Indians, Mexicans and Peruvians. His account of early Greek and Roman surgery is adequate in all respects, and though he does not devote much space to the surgery of the Arabs, he manages to give in a few words an adequate account of Arabian surgery as practiced by its greatest exponent, Albucasis.

The history of the art of surgery during the Middle Ages is particularly good. Brunn makes good use of the many manuscripts which have been discovered and studied by Sudhoff and his school and reproduces many illustrations showing that surgeons during the so-called "Dark Ages" were accustomed to perform many daring operations and that although their knowledge of anatomy was of necessity limited they seem nevertheless to have operated on the most dangerous areas without fear.

The work of the surgeons of the Renaissance, Paré, Fabricius, Hildanus and their contemporaries, is dealt with at length, and then special sections describe how surgical science progressed steadily during the seventeenth century. The great discoveries of the nineteenth century, anesthesia, antisepsis, the roentgen rays, bring the history of surgery to its present apogee. Americans will read with interest the author's references to the achievements of their countrymen. Not only do Physick, Valentine, Mott, Gross and others of the historic past receive their mead, but some of the living also figure in these pages.

Professor Brunn's book is remarkable for its breadth of view and philosophic tone, hardly to be looked for in a condensed narrative. A most notable feature is the profusion of illustrations and their appropriateness to the text. This is particularly striking in those which are used to illustrate the surgery of the Middle Ages and the Renaissance.

An excellent bibliography is appended to the work. It is greatly to be hoped that an English translation will be made of this book which would be of great value to the advanced student of the history of surgery as well as to the neophyte.

Dictionary of American Medical Biography Lives of Eminent Physicians of The United States and Canada, from The Earliest Times. By Howard A. Kelly, m.d., ll.d., Baltimore and Walter L. Burrage, a.m., m.d., Boston. New York, D. Appleton and Company, 1928.

In 1921 Dr. Howard A. Kelly published his "Cyclopedia of American Medical Biography," which was followed in 1920 by "American Medical Biographies," edited by Dr. Kelly with Dr. Walter L. Burrage as his collaborator. The present volume is a new edition of the latter, containing some three hundred new biographies. Some of the biographies which appeared in the "American Medical Biographies" of 1920 have been deleted to make room for some of the new ones, but a reference in the text of this volume indicates where they may be found in the other work. The book is preceded by a list of the chief sources of information which in itself constitutes a valuable guide to the biographic side of American medical history. Source references are not placed at the end of the different biographies nor are they accompanied by a formal bibliography of the subject's writings. Such omission is amply compensated for by the account given in the text of each article of the chief literary contributions of the person whom it describes. The lives are written by many different hands and consequently vary in the method of handling their matter and in literary finish, but as they have evidently been subjected to skilled editorial supervision there is little to complain of on that score.

It would be hard to overestimate the value of the work of Drs. Kelly and Burrage. It is truly a historic record of vast importance not only to the medical historian or student of medical history but to anyone interested in the history of our country. Many of those whose lives are chronicled in its pages played active parts in the communities in which they lived, or served their country in its national councils or military affairs. Benjamin Rush was one of the Signers of the Declaration of Independence; Dr. Joseph Warren was killed at Bunker Hill, and Dr. Hugh Mercer is better known as the General Mercer who fell at the Battle of Princeton. Oliver Wolcott, not only signed the Declaration of Independence, but also became a Brigadier-General in the Continental Army, a member of Congress and Governor of the State of Connecticut. These are but a few of the many physicians whose public careers are recorded in this volume. In literary fields we find Oliver Wendell Holmes, S. Weir Mitchell, and two men, each of whom wrote a poem which entitles them to a niche in English anthology; Thomas Dunn English's pathetic ballad, "Ben Bolt," revived by "Trilby," has a sentimental appeal which will prevent its lapsing again into even temporary oblivion, and the Canadian, John McCrae's, "Flanders Fields" is probably one of the few immortal poems resulting from the Great War. So in every branch of human activity we find the physician taking a large part, and in no country more so than in the United States and Canada. Hence the importance of complete and accurate records of the history of the profession cannot be denied. We are fortunate in having "such an honest chronicler" as Dr. Kelly and his associate, Dr. Burrage.

Francis R. Packard.

Zur Geschichte der Angina Pectoris. Heberden oder Rougnon? Prof. Hans Kohn. Berlin. *Ztschr. f. Klin. Med.*, 1927, B. 106, 1.

This is an interesting discussion of the claim put forward by certain French writers that the credit for the first description of angina pectoris belongs to Rougnon, professor of medicine in the University of Besançon. This is given in a letter to M. Lorry of the Faculty of Medicine in Paris, dated February 23, 1768, in which he describes the case of a Captain Charles who complained of attacks of thoracic oppression which came on suddenly and disappeared abruptly. He died very suddenly. The question is discussed by Sir William Osler in his *Lectures on Angina Pectoris* and he took the view that the case was probably one of angina pectoris, an opinion which was opposed by Sir William Gairdner of Glasgow. Sir William Osler quotes the title of Rougnon's letter as "*Lettre à M. Lorry sur une maladie nouvelle.* Besançon, 1768." Huchard apparently used the expression "maladie nouvelle et inconnue jusqu' alors" (as quoted by Kohn). In the copies of the letter which Professor Kohn has been able to trace, and they are very few, the expression "sur une maladie nouvelle" does not occur.

Professor Kohn has studied the problem and comes to the conclusion that Captain Charles did not have angina pectoris but suffered from emphysema and marked dilation of the right heart with severe dyspnea. In any case he points out, as did Sir William Osler, that Morgagni had described a single case, and some would have it that the credit of the first description belongs to Seneca who said "To have any other malady is only to be sick; to have this is to be dying." In any case to Heberden belongs the credit of having described the malady from the study of a number of cases, and of giving a description to which little can be added or taken away, as well as pointing out the prognosis and treatment.

Thomas McCrae.

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